











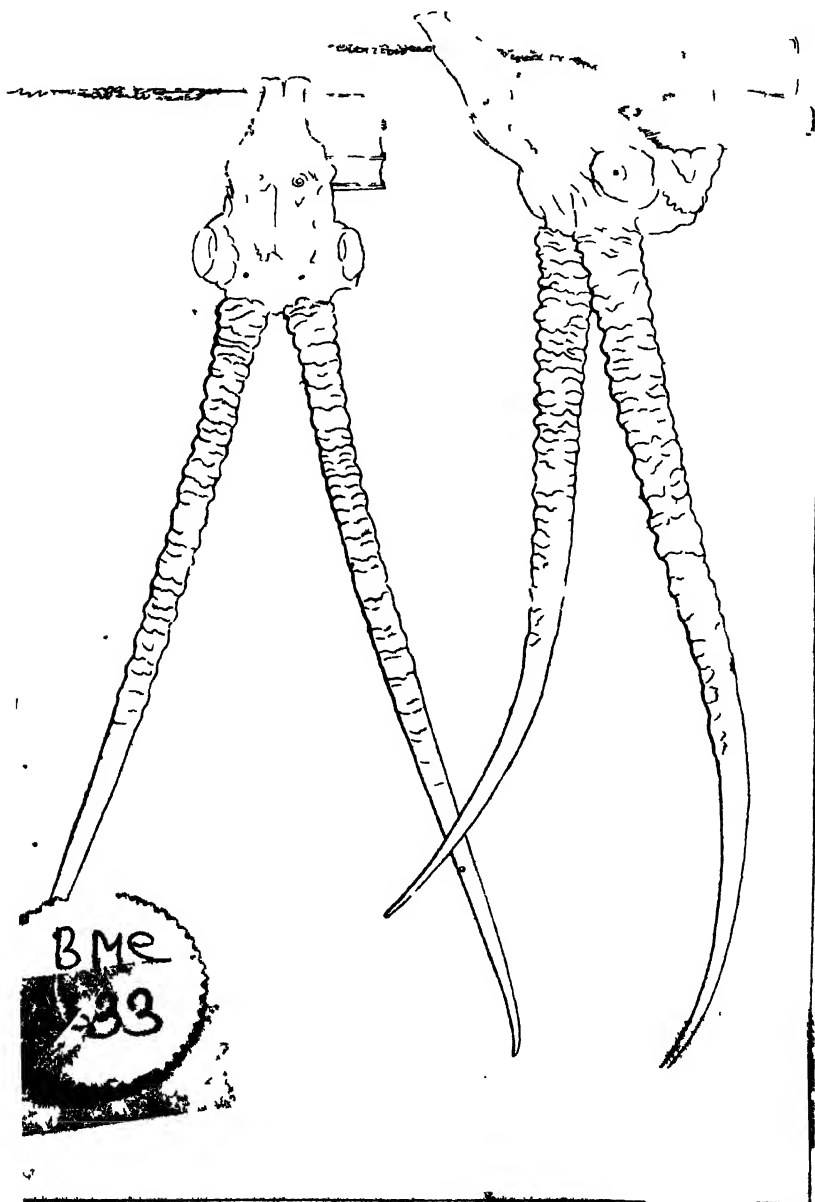


Journal of the  
Asiatic Society  
1832



*mit und oblique von der Skull of the*

*mit und oblique von der Skull of the*





The molar teeth are only five in number, on each side of either jaw\*. The eight incisors of the lower jaw are unusually erect, close, uniform, rounded, with broadish crowns.

*The Horns.*

|   | feet. inch. |                 |
|---|-------------|-----------------|
| Length of the horns, in a straight line.....                  | 2           | 0               |
| Do. do. along the curve.....                                  | 2           | 1 $\frac{1}{2}$ |
| Basal diameter, fore and aft, } between the two lowest rings, | 0           | 1 $\frac{7}{8}$ |
| Do. do. side to side, }                                       | 0           | 1 $\frac{1}{8}$ |
| Basal interval.....   | 0           | 0 $\frac{3}{4}$ |
| Terminal interval.....  | 1           | 2               |

The skull and horns above described are those of an old male, the incisor teeth being long and full of marks, the sutures half obliterated, and the cristæ prominent.

In regard to the precise form and curvature of the horns, I may observe, in addition to what was said in the GLEANINGS No. XXIII. that if you lay a horn, separated from the skull, on a table, with that side downwards which in the natural state faces laterally *outwards*, and apply your hand to the base of the horn, so as to make it rest fairly on the table, you will find the horn touch the table at two points; one, the base merely, the other, the space of an inch situated within four inches of the tip. In other words, these two points form the ends of a long, gentle, lateral curvature, the bend of which is inwards, and its utmost divergency from the chord of the bow, or plane of the table, barely  $\frac{3}{4}$  of an inch.

The tip of the horn you will observe to be elevated from the table about  $\frac{3}{4}$  of an inch; which is caused by a pretty decided inflexure of that part. In young animals, this lateral bend, with the incurvation of the points of the horns, is scarcely traceable: nor is it other than trivial in the oldest. The great bend is the forward one, which is so material, that if you lay the horn on the table with that side downwards, which is the *frontal* surface in the natural state of the animal, (the horn must be supported to make it keep this position,) you will find the horn to touch the table only at the very extremities, the whole of its length being carried off the plane of the table in a bow, the most divergent point of which rises nearly 3 inches from the table, and is situated about  $\frac{2}{3}$  of the horn's length from its base.

\* Three skulls of old animals now by me exhibit uniformly this number of molars.



In size, the horns vary from 22 to 27 inches of straight measurement, and are straighter in proportion as they are less fully grown. The number of the annuli seems to depend on the size of the horns; their development, not so; for in the smallest that I possess the rings are as strongly marked as in the largest. The rings are round-edged, and very fully and uniformly displayed on the frontal surface; much less fully or regularly on the dorsal and lateral surfaces; round both which the annuli are apt to be continued brokenly only and evanescently. As if, however, to prove that the true character of these marks is annulation, you will sometimes find a ring carried all round the horn in equal and full development. The divergency of the horns at their tips is usually as half their length: the interval at the bases so small, that the little finger can barely be passed between the horns in that part.

The lateral compression is always strongly marked, and extends evanescently to within about six inches of the tips of the horns.

The terminal portion is smooth and rounded, and the extreme points sharp, and turned inwards as well as forwards.

*Nepal, March 1, 1832.*

### III.—*Note relative to the Account of the Cervus Jarâi, published in the Gleanings, No. 34, by the same.*

In my description of the Jarâi, above alluded to, I observed that it has “no peculiar elongation of the hair on any part of the body.”

The materials of that description were chiefly derived from the examination of a living animal; which examination was conducted in August, or at the height of the hot-weather, when, there being really no signs of such elongation of the hair, I stated the fact accordingly.

Subsequently, it occurred to me, that the hairy covering of the Ruminantia is apt to vary considerably in character with the seasons as well as with increasing years, and I therefore again visited and examined the individual in question (a young male), in the beginning of February; when, somewhat, to my surprise I confess, I found the inferior surface of his head, as far forwards as the gape, the whole of his neck, and the top of his shoulders, invested with shaggy hair more than twice the length of that of the body. So adorned, the animal is readily assignable, (with the assistance of Griffith's Cuvier, a copy of which I have just received from my bookseller,) to the *Rusa* group of Major H. Smith, and possibly to the species *Equinus* of that able writer. Since my description of the Jarâi was composed, I have received some splendid spoils and important

additional information relative to this animal, or rather group of animals; for, it would appear, by the testimony of some most respectable Nipalese, supported by skins, horns, and skulls, in my possession, that there are at least three distinct species (or most strongly marked varieties) of the Jarái, inhabiting the Saul forest.

The Nipalese distinguish them, with reference to the different shades of their in general uniform dark colour, by the epithets Phúsro, Râto, and Kâlo, or gray, red, and black, Jarái. The Phúsro is the largest, being not less than a horse in size; and has his dark hide copiously sprinkled with Phúsro or hoary. The Râto is the next in point of size; and is of a redder hue. The Kâlo is the smallest, and of a shining, clear black.

The horns of the Râto and Phúsro have a similar form and character, the only *invariable* difference between them being, that those of Râto are considerably less in proportion. The horns of the Kâlo, on the other hand, present a character, not merely alien to the two others, but to the type and index of the group; for they have only one antler on each beam, viz. a brow antler.

All three species have the forehead flat or sunk, with a strong ridge down its centre; the nose straight; canines in the upper jaw, large lachrymary sinuses; shoulders, whole neck, and jaws, shaggy; very coarse, dark hair; longish tail; fan-like ears; massive rough horns, inclined outwards and backwards, which are set on stout pedicles, terminated by large granulated burrs. All, too, but the Kâlo species have a subterminal, as well as a brow antler.

The whole of the above characters are constant. But no reliance can be placed on the circumstances of the superior antler being thrown off near the top, or near the centre, anteriorly and externally; or, posteriorly and internally: nor upon that of the inferior antler being basal, or only subbasal.

I make these remarks, guided by Major H. Smith's admirable work, with ten good specimens before me; and I feel pretty confident that, that able author will find reason by and bye to abandon his present distribution into species of this group of Deer. With the wish to be of service to him I subjoin drawings of the horns of the three presumed species of Nipal; but shall not attempt any further description of them at present. I apprehend that the Nipalese Phúsro Jarái is identical with the great *Rusa*, or *Hippelaphus*, of Cuvier; that *Cervus Equinus* may be the Râto Jarái; and possibly, the *Rusa Ilam* of Raffles (which he says is smaller than *Equinus* and black-coloured) the Kâlo Jarái of Nipal.

IV.—*On Modes of obtaining Important Results by Simple Means.*By Capt. G. Twemlow, *Bomb. Arty.*1st.—*Movement of heavy masses without expence of Machinery.*

Most persons may some time or other have to raise heavy bodies, or move ponderous masses, without having command of modern mechanical means; a few retrospective glances to the probable modes practised in ancient times, by comparatively rude nations, may perhaps elicit useful hints.

We know that in very remote times, enormous stones, such as no modern machinery could be made to lift, were placed on the tops of walls, or fixed over pillars to form gateways: for instance, “in the ruins of Balbek, (the ancient Heliopolis of Syria,) there are three stones lying end to end, in the same row, extending sixty-one yards. One of them is sixty-three feet long, the other two sixty each; their depth is twelve feet, and their breadth the same; and, what adds to the wonder, they are raised up into the wall above twenty feet from the ground\*.” Were these stones swung up by machinery? most probably not; labour having been cheap, it is far more probable, that as the masonry advanced, an inclined plane of earth would be progressed; up which the common materials would be conveyed by donkies, camels, and labourers, as we read of in the accounts of ancient works: and this in hot climates would admit of lime-cement binding well and gradually. Having the inclined plane, there would be no difficulty in rolling the sixty feet in length stones up it, to their intended positions on the top of the wall, there being an inclined plane on each side. When the work was finished and the cement (if used) been allowed time to bind, the earth would be removed, and be used in levelling the grounds, forming terraces or in other modes. It will be found that in eastern climes the expence attending this mode of scaffolding is much less than that of machinery, where very heavy masses have to be raised†. Let us take another instance.

Suppose you had to place on two erect pillars, or pointed rocks, an enormous impost stone, similar to the egg-shaped stone said to be still existing in the parish of Constantine, Cornwall, England. “The longest diameter of this stone is thirty-three feet, pointing due north and south,

\* Extract from Maurice’s *Indian Antiquities*, vol. vi. page 142.

† In throwing arches of small span, the cheapest plan for (or instead of) centerings, where labour is cheap, is to erect two temporary walls; and fill the space between them with earth, or stones, bricks, &c.

end to end; it is fourteen feet six inches deep, and contains at least seven hundred and fifty tons of stone\*."

Say the pillars are twenty feet in height, and firmly embedded, would you not be at a loss how to apply modern aids or obtain fulcra? Yet the thing is easy of accomplishment, if we would condescend to do what the people of old would have done; that is to say, employ the cheapest mode of imbedding the two pillars up to their tops in earth, so as to form an inclined plane equally all round them. Now, suppose the impost stone to be at the foot of the inclined plane, what would be the least expensive mode of rolling it to the top? I will give one plan to be followed, should there be no mechanical aid available other than obtainable by levers and ropes—men however being plentiful. Having procured twenty stout timbers of twenty-five feet in length, to one end of each I would attach a cable; the other ends I would insert at equal distances apart, perpendicularly (or rather sloping backwards) along the upper surface of the mass to be moved; the ropes being pulled on, by a sufficient number of men, the levers must be brought down to the ground, making the mass of stone turn nearly a quarter of its circumference, having people ready with earth and stones to throw behind it, to prevent retrogression: the stone-cutters will then cut out another set of lever-insertion holes, the levers be again applied, and the stone be turned over a second quarter turn; and so on, until there are lever-insertion holes on the four sides†, so that it may be turned over and over until it gets to the top, and is fixed on the pillars: then remove the earth, and the task is accomplished. If it should so happen, that the number of men are deficient to furnish power to pull down the levers, the cables might in that case be made fast to anchor stakes on the reverse inclined plane, taking a double turn of each; then by twisting the two ropes with hand levers inserted between them, enormous power may be obtained: this in fact was the power of the catapult and other ancient artillery. In the Dekhan, the power of twisted ropes is to this day made much use of. A *kúbi* (cultivator) will pile up an enormous height of straw on his cart, and then throw over the load several sets of ample ropes, with snatch-blocks of a simple construction at each end of them fastened to the side of the cart; then by twisting the ropes he will compress his load to a surprising degree.

Now let us consider how to move by simple means, masses which are nearly cylindrical, to considerable distances. For instance, ancient

\* Maurice's Indian Antiquities, vol. vi. page 140.

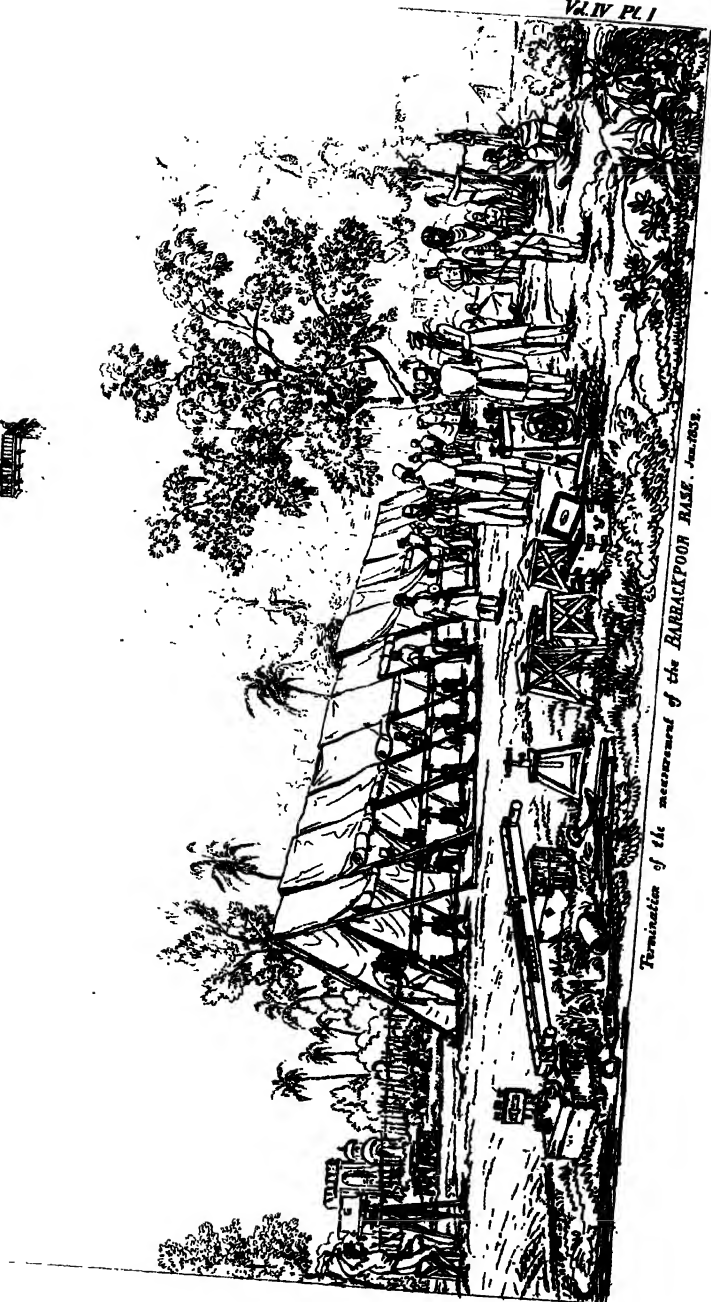
† Not however opposite each other, or so deep as to injure the stone.

pillars or statues, or enormous guns, as trophies. If wood is cheap and abundant, perhaps the easiest plan is, to fit beams of wood round the mass, after the manner of staves, so as to barrel it up into the shape of a cylindrical roller.—It has been practically proved, that an iron 18 pr. siege gun, weighing forty-two hundred weight, barrelled up in this way, the staves being about five inches thick, fitted exactly to the rings, astragals, and fillets of the gun, will travel easily on good roads with four gun bullocks, and over common roads with eight bullocks of 54-inches standard; inequalities in the roads, or even heaps of stones which would upset a gun carriage, are no obstruction to the barrelled up gun; some part of the cylinder is sure to act as a wheel. Narrow ravines or passes would be the only difficulty: the neck of the caseable has a ring passed over it, and forms the axle at one end; whilst an axle arm inserted in wood is driven into the muzzle of the gun, to form the opposite axle of the cylinder.

The Bijapúr gun, which weighs about forty two tons, might be moved to the coast in this way with forty pairs of good gun bullocks. It should be encircled with staves of tough wood, twelve inches in thickness, closely fitted to the surface of the gun: the staves to be dove-tailed and cross-pinned together, and then strongly hooped up; the centre of the cylinder to be purposely made rather larger than the ends, to admit of driving the hoops tight, and also to enable it to travel better: it would then form a roller six feet in diameter and fifteen feet in length, and might serve to roll a road to the coast. A powerful capstan (such as that described in the *Memoires D'Artillerie*, vol. 2., third edition, page 156,) might be carried on a cart to aid in passing the cylinder over mountains, and to drag it through rivers. It is believed that this plan would be better than two or more broad girdles or wheels round the gun. Let it not be supposed, however, that artillery officers of the present day would have any difficulty in making a suitable carriage for it: if it were desirable to go to that expense, a carriage might easily be made. An Italian of Otranto, who served in the Moghul armies, under the title of Rûmî Khan, had this gun in his park, and used it in several battles, occasionally firing sacks of copper coin out of it.

*(To be continued.)*





*Termination of the measurement of the BARRACKPOOR RISER. Jan. 1858.*

## V.—SCIENTIFIC INTELLIGENCE.

1.—*Progress of the Indian Trigonometrical Survey.*

## PLATE I.

The measurement of the base line on the Barrackpúr road was completed on the 21st January, and it is difficult to imagine that any similar work was ever brought to a more successful issue. Through the politeness of Captain Everest, the Surveyor General and Superintendent of the Trigonometrical Survey, we enjoyed the advantage of an invitation to witness the remeasurement of the first day's work, with the view of ascertaining what might be the probable amount of error : on which occasion the President of the Physical Class of the Asiatic Society and many distinguished officers of the Engineer department were present. An elegant breakfast was laid out in tents after the ceremonies of the morning were concluded. While contemplating with admiration the order and precision with which the whole process was conducted, we took an opportunity of sketching the apparatus as it stood, that the readers of the Journal might be better able to comprehend the nature of the operation of measurement which was partially described in the GLEANINGS for November last.

Plate I. represents the six sets of bars resting upon their tripods, levelled, and in the act of adjustment, longitudinally, by means of the directing or boning telescope, to the left hand. The boning telescope ought to have been considerably more distant from the bars, but it would then necessarily have been excluded from the drawing. A movable covering of tent-frame work protects the bars from the influence of the morning sun ; at their left extremity is seen a cast-iron tripod, firmly imbedded in the ground, bearing a brass vertical cylinder and plate, upon the surface of which is the minute dot which marks the termination of the last, and acts as the starting point of the present measurement : by the adjustment of the cross wires of the end microscope in the true vertical line bisecting the dot. These apparatus are represented on a larger scale in the foreground ; as also one of the wooden boxes containing the compound bar, shewing the two projecting tubes, within which lie the cross levers of the compound bars, upon which are engraved the dots, or marks to be read off by the double microscopes interposed between each box, as described on a former occasion, and as will be readily comprehended by reference to the drawing. The right extremity of the line is seen to enter the door of the tower, where it terminated in a coincidence with the original dot, engraved upon a metallic disc attached to a sunken stone pier.

As it had been anticipated that the settling of the masonry of the tower might derange the terminal mark, precautions had been taken in the first instance to sink into the ground another adjusting point at a short distance in advance of the tower ; and it was in fact to this point that the remeasurement was referred, to know the probable amount of error in measuring, as well as whether the tower had altered its position in any perceptible degree.

From conversation with the officers on the ground we picked up the following particulars regarding the Barrackpúr base. We must crave their indulgence if our memory leads us into any mistake in detailing them.

The measurement commenced on the 23d November 1831, and ended on the 21st January 1832, an interval of 58 days, of which 13 may be set down as holidays ; so that the actual time employed was about 45 days. The length of the ground measured upon an average was 750 feet, or 12 sets of bars : but towards the conclusion, so systematic had become the arrangements, that 18, 20, and once 24 sets (that is 1512 feet) were measured in one day, which is double what was effected on the Irish



survey : this was chiefly attributable to the number and experience of the officers employed ; whose names we must be allowed to record, as we observed them at their posts.

At the hoking telescope,... Lieut. Western, Engrs. with Lieut. Bridgman, Art.

First microscope,..... Mr. J. Taylor, astronomer at Madras.

|                         |  |  |
|-------------------------|--|--|
| Central microscopes,... | $\left\{ \begin{array}{l} \text{Mr. Logan,} \\ \text{Mr. T. Oliver,} \\ \text{Mr. J. Peyton,} \\ \text{Mr. M. Torrick,} \\ \text{Mr. W. Rossenrode,} \end{array} \right\}$ | $\left\{ \begin{array}{l} \text{Of the Madras} \\ \text{Trig. Survey.} \end{array} \right\}$ |
|-------------------------|--|--|

Last microscope,..... Lient. R. Wilcox, Surveyor of the Brahmaputra River.

The length of the BASE between tower and tower was nearly 34,000 feet, or 6.4 miles, being 539 sets of bars. The whole of this extensive line came within the limits of the Barrackpúr road, falling about 30 feet to the eastward of its centre at one place ; and the greatest deviation from horizontality in the road was at about a mile from the south tower, to which point it sinks gradually about  $5\frac{1}{2}$  feet.

At the north tower, it was found beforehand that there would be about 3 feet to spare in excess of a certain number of bars. This, added to the possibility of the dot on the centre stone moving during the settling of the tower, induced Captain Everest to adopt the expedient of sinking a heavy stone of  $3\frac{1}{2}$  feet cube, into the ground, at the distance of one set of bars south of it : two brass plates were let into this, one to receive a dot at the exact distance of a set of bars from the tower, and one to receive the dot terminating the 538th set. By this arrangement the surplus interval could be measured at leisure, with the same accuracy employed throughout the remainder of the line.

The difference found on remeasuring eleven sets of bars was .026, or one-fortieth of an inch on 700 feet—a surprizingly small quantity, and only one-third of what was experienced in the previous trial at Lord's cricket ground. To form a tangible idea of the error this might induce upon the result, it is sufficient to say, that it would amount to about 12 feet between Calcutta and Delhi, or 125 feet in the diameter of the great globe itself.

This, it must be remembered, is without applying any correction for temperature, though the two measures were taken in November and January : and it is a convincing proof how well the compensation had been adjusted in England.

The southern tower was found to have moved one-thirteenth of an inch to the south-east, which is not surprising, considering the light nature of the soil, and the height, 80 feet, to which the building was forced to be raised to place the theodolite within view of the other triangle stations.

Upon the conclusion of the great work, the bars were brought to Calcutta, to be recompared with the standard at the Surveyor General's office. But for the minute particulars of this and all the other processes we must wait for the public account that will doubtless be eventually given of the whole operation.

We hear that Lieutenant Western is now deputed to carry a meridional series of triangles southwards from the Parisnath meridian on the longitudinal arc, to Cuttack. After which the same meridian is to be prolonged northwards to the limits of our frontier. We presume, that the bars will shortly be transferred to the neighbourhood of Agra, where another base will be necessary for the primary meridian. Should an intermediate line be required, none could be found better suited to the purpose than the military road between Benares and Allahabad, which enjoys the same advantages of straightness, even level, and hard materials, with that of Barrackpúr ; added to much greater openness of country.

2.—*Climate of Vera Cruz.*

Allusion was made in our last, to a meteorological register kept by Fray Juan, at Vera Cruz; as the tables whence the notice was derived are in manuscript, we think it will be interesting to publish the following abstract of them, drawn up for the purpose of elucidating the subject of the barometric tide.

*Table of Observations on the Barometer and Thermometer, at Vera Cruz, by Fr. Juan, 1817, 1818.*

| Month.           | Thermometer. |       |          | Barometer at 32°. |       |          |
|------------------|--------------|-------|----------|-------------------|-------|----------|
|                  | 6 A. M.      | Noon. | 10 P. M. | 6 A. M.           | Noon. | 10 P. M. |
| January, .....   | 68.0         | 70.3  | 69.8     | 30.052            | .069  | .034     |
| February, .....  | 69.0         | 71.5  | 70.7     | .043              | .050  | .034     |
| March, .....     | 72.1         | 75.6  | 74.7     | .000              | .002  | .002     |
| April, .....     | 76.8         | 80.7  | 79.7     | 29.879            | .885  | .871     |
| May, .....       | 79.2         | 84.1  | 83.1     | .860              | .866  | .855     |
| June, .....      | 80.6         | 83.9  | 82.8     | .828              | .830  | .825     |
| July, .....      | 79.8         | 83.4  | 82.2     | .955              | .954  | .957     |
| August, .....    | 79.9         | 83.6  | 82.6     | .890              | .900  | .897     |
| September, ..... | 79.7         | 82.3  | 82.3     | .897              | .909  | .909     |
| October, .....   | 78.6         | 81.0  | 80.4     | .907              | .918  | .928     |
| November, .....  | 74.6         | 77.7  | 76.7     | .965              | .966  | .964     |
| December, .....  | 69.7         | 72.6  | 71.6     | 30.025            | .044  | .048     |
| Means, .....     | 75.66        | 80.56 | 78.05    | 29.941            | .950  | .943     |

3.—*Range of the Barometer at Berhampur.*

We also alluded to the barometric observations made by the late Dr. Alexander Russell, at Berhampur, in 1820—21: of these too, we take this opportunity of putting on record an useful summary made out by a friend, and reduced to the temperature of 32°, by applying the correction calculated from the thermometric register kept in Calcutta, for want of the local observations: the differences cannot be very great.

| Month.        | Sun-rise. | Maximum between 9 A. M. and noon. | Minimum between 4 P. M. and 6 P. M. | Diurnal Tide. | 10 P. M. | Rise to Sun-rise. |
|---------------|-----------|-----------------------------------|-------------------------------------|---------------|----------|-------------------|
|               | inches.   | inches.                           | inches.                             | dec.          | inches.  | dec.              |
| January, ..   | 29.915    | 29.925                            | 29.831                              | 0.094         | 29.881   | 0.034             |
| February, ..  | .850      | .874                              | .766                                | .108          | .824     | .026              |
| March, ..     | .762      | .788                              | .699                                | .119          | .693     | .069              |
| April, ..     | .669      | .686                              | .570                                | .116          | .661     | .008              |
| May, ..       | .553      | .570                              | .466                                | .104          | .533     | .020              |
| June, ..      | .450      | .453                              | .382                                | .071          | .438     | .012              |
| July, ..      | .450      | .457                              | .401                                | .056          | .450     | .000              |
| August, ..    | .494      | .501                              | .413                                | .088          | .480     | .014              |
| September, .. | .615      | .620                              | .563                                | .063          | .604     | .011              |
| October, ..   | .783      | .803                              | .740                                | .063          | .774     | .009              |
| November, ..  | .837      | .861                              | .781                                | .000          | .828     | .009              |
| December, ..  | .904      | .922                              | .826                                | .096          | .877     | .027              |
| Means, ..     | 29.690    | 29.705                            | 29.619                              | .086          | 29.670   | .020              |
| Range, ..     | .465      | .472                              | .459                                |               | .443     |                   |

## 4.—Hourly Observations of the Barometer in the Fortress of Cavite.

The following notice, extracted from the Royal Institution Journal, No. IV. bears upon the same point; and from the blank left opposite to the second fall, we may conjecture that in fact the existence of this fall or nocturnal tide was hardly borne out by the observations when corrected for temperature, although from being apparent before correction the words remained un erased.

These observations were made by the scientific men attached to Captain Kotzebue's expedition in the year 1823—1826, on the Island of Luzon (14° 34' north lat., and 239° 9' west of Greenwich), for ascertaining the periods of its regular falling and rising during twenty-four hours. The barometer was kept in a room six toises above the level of the sea, in which the temperature was nearly the same day and night, (about 25° Centigrade, or 77 Fabr.) and the observations were made on eleven different days between the 12th and 26th of December. The following are the general results deduced from the whole of the observations. The barometer has a maximum of height at 9° 1' 1" A. M.

|                            |     |     |     |     |   |    |   |       |                           |
|----------------------------|-----|-----|-----|-----|---|----|---|-------|---------------------------|
| it then falls till         | ... | ... | ... | ... | 4 | 28 | 6 | P. M. | on an average 1.04 line ; |
| it rises again till        | ... | ... | ... | ... | 9 | 58 | 3 | P. M. | „ 0.687 „                 |
| and falls again till       | ... | ... | ... | ... | 4 | 30 | 0 | A. M. | —                         |
| lastly it rises again till | ... | ... | ... | ... | 9 | 1  | 1 | A. M. | on an average 0.445—      |

## 5.—Dr. Wise's Ice Manufacture at Húgh.

Dr. Wise hopes to maintain a constant supply of ice, in Calcutta, for the next two or three months. Last cold season, although apparently so favorable for its production, did not afford more than 15 nights in which ice would form; and of these, only three or four were really good nights. In consequence of this, instead of 3,000 *mans* as expected, only 1,000 *mans* were secured; which, from the precautions taken, will, perhaps, answer for several months. Dr. W. has devised the following simple and effectual method of using the ice. The ice is contained in a stuffed bag, having two, three, or four holes in its under-part, with padded flaps to close them. The necks of the bottles to be cooled are thrust upwards through these holes; when not wanted, the bag is put into the upper part of a stuffed basket and wrapped round with a blanket.

## VI.—Proceedings of Societies.

## 1.—ASIATIC SOCIETY.—Physical Class.

Wednesday Evening, 8th February, 1832.

The Honorable Sir Edward Ryan, President, in the Chair.

The following Donations to the Museum were presented :

1. Specimens of the Limestone of the Sylhet quarries, from William Cracroft, Esq.

Impressions of *nummulites* abound in the limestone of the Chirra hill, west of the Sanatorium. *Turritiles* are less common, and impressions of bivalves, resembling *pectens*, are still more rare. The interior of the shells is filled with carbonate of lime, crystallized, of a brown colour.

No. 5. A granular limestone, stated, in Mr. Cracroft's list, to be "a poorer lime than the others in the kiln," proves to be a crystallized dolomite; and this circumstance accounts for the occasional mixture of magnesia in the Sylhet lime of the Calcutta market.

There are also specimens of *amygdaloid*, (containing worn crystals of *felspar*), and of a fine plastic micaceous clay, from below the sandstone of Chirra Punji.

2. A stuffed specimen of a species of *Felis*, native of the Midnapur jungles, \* from Dr. J. Pearson.

It is classed and described in the following manner, by Doctor Pearson :

|         |                      |       |
|---------|----------------------|-------|
| " TRIB. | <i>Digitigrades.</i> | Cur.  |
| FAM.    | <i>Felinæ.</i>       |       |
| GEN.    | <i>Felis.</i>        | Lin.  |
| SP.     | <i>Kutas.</i>        | Mihi. |

*Gen. Ch.*—Incisors  $\frac{3}{4}$ ; canines  $\frac{1}{2}$ ; cheek teeth  $\frac{3}{4}$ ; the fourth in the upper jaw transversely situated. Jaws short. Toes, on the anterior extremities, five; on the posterior, four, armed with retractile claws.

*Sp. Ch.*—Ground colour, greyish brown, approaching to rufous at the sides of the abdomen, and neck, where it unites with the white of those parts; and marked with darker stripes and bands, which are more or less obscure. Inferior surface, chin, and throat, white. Ears, white within; externally rufous; with an irregular dark patch at their lower part, tipped with black and slightly pencilled at the tips. Labial whiskers, some entirely white, and a few all black; whilst others are black for a very small space at the base, the remainder being white. Tail, short, grey, annulated with black, from the middle to the extremity. Legs, greyish, rufous above, and rufous below; with bands of dark-grey, which become on the inner side of the elbow and fore arm almost black. Tarsus, metatarsus, and toes, rufous, darker behind, and almost black at the heels; length from the tip of the nose to the insertion of the tail, two feet two inches; length of tail, ten inches. Height, at the shoulders, one foot two inches; posteriorly, one foot four inches. Caudal vertebrae, twenty.

The size of the *Kutas* is that of a large Chacal, though not so robust as that animal. The darker shades on the sides appear as though they had been less obscure in the youth of the animal, and gradually fading, become broken stripes and even spots, in their progress to a total obliteration; a circumstance which, as there is reason to believe, occurs in more than one species of this family. My specimen is a full grown, but not an old male; the female, and the young, I have never seen.

I have looked through a list of the species described in the Monograph of the *Felinæ*, by Mr. Temminck, without being able to satisfy myself of that distinguished zoologist having met with the animal I now present to the notice of the Society: nor can I discover it in the Synopsis, appended to Griffith's translation of the *Règne Animal*; and therefore I have ventured to designate it by the name which is given to it by the natives of Midnapur. The *Felis Chaus*, Bruce's booted *Lynx*, would appear to differ in colour, and length of tail; and the *Kutas* is destitute of the black at the hinder part of the leg, which forms so distinguished a feature in that animal, having merely an approach to it, in a dark shade of rufous brown. The Bengal Caracal, of Edwards, differs still more in colour and length of tail. Should, however, the *Kutas* prove to be identical with any known species of *Lynx*, my name can readily be dropped."

3. A series of the land and fresh water shells of the Doab, and of the Gangetic provinces, presented by W. B. Benson, Esq., C. S.

## LAND SHELLS.

1. *Helix*—from banks of Ganges, in Behar, and of the Betwa, in Bundelkhand.
2. *H.*——. Lamarck—Bundelkhand and Behar. The exuviae plentiful above Hugli.
3. *H.—Macrochlamys Indicus* (Benson), separated from *Helix*, on account of the difference of character in the animal.
3. *Pupa*—Bundelkhand and Doab.
4. *Bulimus*—allied to *B. Bengalensis*, Lam. Bundelkhand and Doab.
5. *Bulimulus*—under stones and pots, and among grass. Doab and Bundelkhand.
6. *Succinea*—sides of ravines. Etawah.
7. *Carocolla reversa*—a variety from banks of Jellingi and Sikhrigali.
8. *Cyclostoma Beharicum*—Benson—Patharghata.
9. Ditto ditto, variety.
10. Ditto young of ditto.
11. Ditto *granulata*—Bundelkhand and Doab.

## FRESH-WATER SHELLS.

12. *Planorbis*—Jhils in the Gangetic provinces.
13. *Lymnæa*—Jhils near the Sinde, Bundelkhand.
14. Ditto—Bhagea nala, near Kalinjar.
15. *Melania*—From the Gumat: observed the exuviae of this hill in Jellingi, at Kishennagar.
16. Ditto—Ganges, its branches, and Salt-water lake near Calcutta.
17. Ditto—Gumat and Gogra.
18. *Paludina Bengalensis*—Jhils of Gangetic provinces.
19. Ditto *ceramcopoma*—ditto and adhering to rocks in the river Ken.
20. *Ampullaria*—from jhils in Bundelkhand.

## Fresh-water Bivalves.

21. *Cyrena*—Ganges and its branches.
  22. *Unio*—Gumat and Gogra.
  23. Ditto—Ganges and its branches.
  24. Ditto—Jumna and Ganges.
  25. Ditto—Ganges and branches.
  26. *Novaculina Gangetica*—Benson—Jumna.
- Mr. Benson has further obliged the Society by classifying the shells formerly received from Dr. Pearson of Midnapur; they consist of the following:

## FRESH-WATER SHELLS.

## LAND SHELLS.

- |                                  |  |
|----------------------------------|--|
| 1. <i>Planorbis</i> .            | 5. <i>Helix</i> .  |
| 2. <i>Melania</i> .              | 6. <i>Carocolla</i> .  |
| 3. <i>Paludina Bengalensis</i> . | 7. <i>Bulimus Bengalensis</i> ,—a variety with three lower bands on the whorl. |
| 4. <i>Ampullaria</i> .           |  |
| 8.— <i>Cyclostoma</i> .          |  |

To these catalogues, for the sake of reference, the following list of American shells presented in the name of Mr. Lea, at a former meeting, is subjoined.

24 varieties of the *Unio*, chiefly from the Ohio river.

|   |  |                                |
|---|--|--------------------------------|
| <i>U. tuberculatus</i> , Barnes.              | <i>U. æsopus</i> , Green.                      | <i>U. perplexus</i> , Lea.     |
| <i>U. ovatus</i> , Say.                       | <i>U. metaneveer</i> , Rafin.                  | <i>U. zigzag</i> , ditto.      |
| <i>U. plicatus</i> , Lesueur.                 | <i>U. ellipsis</i> , Lea.                      | <i>U. undulatus</i> , Barnes.  |
| <i>U. securis</i> , Lea.                      | <i>U. pustulosus</i> , ditto.                  | <i>U. foliatus</i> , Hildreth. |
| <i>U. nasutus</i> , Say. Schuyllh.            | <i>U. complanatus</i> [ <i>purpureus</i> ].    | <i>U. gibbosus</i> , Barnes. • |
| <i>U. torsus</i> , Rafin.                     | <i>U. irroratus</i> , Lea.                     | <i>U. cariosus</i> , Say, Sch. |
| <i>U. occidentis</i> , Lea.                   | <i>U. siliquidicus</i> , Barnes.               | <i>U. rectus</i> , Lane.       |
| <i>U. mytiloides</i> , Rafin.                 | <i>U. cuneatus</i> , ditto.                    | <i>U. circulus</i> , Lea.      |
| <i>Venus</i> , <i>Mercatoria</i> , N. Jersey. | <i>Melania</i> <i>Virginica</i> , Say, Sch.    |                                |
| <i>Symphynota alata</i> , Lea, Ohio.          | <i>conica</i> , ditto, Ohio.                   |                                |
| <i>ochracea</i> , Sch.                        | <i>canaliculata</i> , ditto, ditto.            |                                |
| <i>Solen ensis</i> , Lam. N. Jersey.          | <i>multilineata</i> , ditto, Sch.              |                                |
| <i>Achatina vexillum</i> , do. Cuba.          | <i>armigera</i> , ditto, Ohio.                 |                                |
| <i>Alasmadonta undulata</i> , Say, Sch.       | <i>Helix</i> , <i>albulabris</i> , Say, ditto. |                                |
| <i>Murex capillis</i> , Massts.               | <i>thyroides</i> , ditto, ditto.               |                                |
| <i>Spirula peronia</i> , Florida.             | <i>anculosa preciosa</i> , ditto.              |                                |
| <i>Petricula fornicata</i> , Say, N. Jersey.  | <i>Turbo</i> , <i>irroratus</i> , New Jersey.  |                                |
|   | <i>muricata</i> , Cuba.                        |                                |

Mr. Benson, on departing for Europe, begged the Society's acceptance of his copy of Lamarck's "*Histoire Naturelle des Animaux sans vertèbres*," the five first volumes.

4. A letter was read from Dr. Royle, late Superintendent of the H. C. Botanical Garden at Seháránpúr, presenting to the Society—

1. A plan and description of the Botanic Garden at Seháránpúr, with catalogues of the contents of the Garden and of the Herbarium. [Printed in the present Number.]

2. Drawing of the Alpine Hare, or *Pika* of Buffon, of the natural size, from the Chúr mountains, at eleven thousand five hundred feet of elevation.

3. Specimen of a rich Iron Ore, (magnetic,) from the Phagúní mine, on one of the branches of the Chúr mountain.

4. Specimen of the Trap Rock, or Dyke, discovered near Masúrí by Lieutenant Cautley, from Dr. Falconer.

5. Specimen of the *Bijl-ke-hár*, alluded to in Captain Herbert's paper.—[GLEANNINGS III. 269.]

A note by the Secretary pointed out that the substance of these bones has not undergone mineralization, as supposed by Captain Herbert, excepting in so far as they are impregnated with iron. The animal matter of the bones takes fire at a red heat, and the bone, on cooling, is of a fine blue colour, resembling the *Odontolite*, or *Bone Turquoise*, of Johns. The composition, on a hasty analysis, was found to be—

|  |     |
|--|-----|
| Animal matter, . . . . .                   | 12. |
| Phosphates of lime and magnesia, . . . . . | 70. |
| Carbonate of lime, . . . . .               | 14. |
| Oxide of iron, . . . . .                   | 2.  |

The interior of the bones is filled with calcareous crystals.

Mr. B. H. Hodgson's paper on the Mammalia of Nepal was then read.

Also, Dr. Royle's description of the Garden at Seháránpúr.

The thanks of the Society were voted for the above contributions.

**2.—MEDICAL AND PHYSICAL SOCIETY.***4th February, 1832.*

Dr. Madden was elected a Member of the Society : and Dr. William Chalmers, of Croydon ; Mr O. Walter, Surgeon, of Dover ; and Senor Don Francisco Xavier Lazo, M. D. Secretary of the Medico chirurgical Society of Cadiz ; were elected corresponding Members. Hugh Guthrie, Esq. Assistant Surgeon, Bengal Service, requested to return to the Society, and have his name replaced on the list of Members, agreeable to the resolution passed on the 4th April, 1829, which was complied with accordingly. Several communications were then laid before the Society.

1.—A letter from Dr. J. N. Casanova, a corresponding member, stating that, as he had resolved to reside permanently in Calcutta, he was desirous of being admitted a resident member of the Society, for the purpose of contributing his subscriptions, and assisting at the meetings ; he was therefore proposed as a member of the Society, by Mr. Egerton and Mr. Twining.

2.—A letter from Dr. Milne, of Bombay, enclosing his 3rd communication on Dracunculus, with three reports, numbered 4, 5, and 6, in support of his opinions on that subject.

3.—A communication from Brigadier O'Halloran to the Secretary, accompanied with the root of a plant similar to that presented at the last Meeting from Dr. Robert Tytler, and said to possess the property of preventing the scorpion from stinging.

4.—A statement from Mr. Boswell, relative to the benefits he had seen follow the employment of venesection in the cold stage of Intermittent Fevers, while he was employed with the Artillery at Dum-Dum, where he had employed this treatment in obstinate agues with invariable success, and only in one instance was obliged to repeat the bleeding in the cold stage.

5.—A letter from H. Guthrie, Esq. with remarks on a native prescription for ring-worm.

6.—A letter from J. L. Geddes, Esq. Assistant Surgeon, Madras Service ; with the statement of a case in which the Madar had proved remarkably successful in the cure of an obstinate ulcer.

7.—A letter from Dr. D. Stewart, of Howrah, stating that, during an excursion to Shikarpore, he had been consulted by a Native young man, who had suffered for five years from nasal polypi ; whereby his health had become much impaired, and in fact, the patient was reduced to a skeleton. The disease had acquired an enormous bulk, pressing down into the posterior fauces and pharynx, so as to prevent the deglutition of any solid food, and to embarrass the respiration exceedingly ; and probably also to affect the circulation, as the patient suffered from distressing head-aches. The disease was effectually removed by ligature and torsion.

Dr. Smyttan's Treatise on the varieties of East India Opium, was read and discussed by the Meeting. Dr. S. observes, that the varieties of East Indian Opium seem to be little known or recognised in Europe, and that good Turkey Opium is said to contain nearly three times the quantity of morphine, or narcotic principle, that is found to be procurable from the product of the Bengal provinces. The best produce of the Malwa districts is said to differ from Bengal Opium both in appearance and quality, quite as much as the Turkey Opium does. Dr. Smyttan's opinions are formed from extensive observations made while he was Inspector of Opium at Bombay, compared with the records of that office ; and with the experiments made at Calcutta by the late Dr. Jameison in 1821, which are given with a

table in the Appendix : to which is annexed a table of experiments made at Bombay by Dr. Maxwell. The whole of these appear to have been conducted with great care and attention. The general results of a series of experiments conducted by the Author, are corroborative of the accuracy of the tables alluded to in this paper.

At the conclusion of the Meeting, some splendid drawings of Medicinal plants were placed on the table by Mr. Royle.

### 3.—SOCIÉTÉ D'HISTOIRE NATURELLE of the Mauritius.

8th March, and 12th April, 1831.

The Secretary presented to the Society, the Baron Cuvier's *Analyses des Travaux de l'Académie des Sciences de Paris*, for 1822, 25, 26, 27—in the name of the illustrious author.

Mr. Rob. Lyall, M. D. read a note on the subject of the astronomical observations made by him at *Tannanarivou*, capital of the kingdom of the Ovas, in Madagascar, whence the latitude of the place was found to be  $18^{\circ} 56' 20''$  S. and the longitude  $47^{\circ} 57' 46''$  E. of Greenwich.

The same member also described two plants, met with in Madagascar by M. W. Bojer. One is the *Euphorbia splendens* nos. now become common in the gardens of the Mauritius, but of which Dr. L. made known a variety with a yellow flower. The other is the *Poinciana Regia* nos. now also naturalized in the island. Both are figured in the last numbers published by Professor Hocker, of Glasgow, a corresponding member of the Society.

M. Léonard Péro read an account of a fish of this island, belonging to the genus *Pleuronecte*, and remarkable for certain rays on the pectoral fins, extending the whole length of the animal; a drawing accompanied. The islanders rank this fish among the soles.

M. J. Desjardins continued his analysis of *Zoologie du Voyage de l'Uranie*, chiefly adverting to the Polypi, which play so important a part in the natural history of the island.

The Secretary also described the hail, which fell in the storm of 8th February, at the *Camp de Masque*, as of the size of small pens, proving destructive to tender plants.

Many letters of correspondents were communicated. One from M. Quoy, of Paris, stated, that M. le Baron G. Cuvier had yielded to the desire of the Society, to become possessed of his bust. The following paragraph added weight to M. Desjardins's observations. "Détruisez donc cette opinion populaire du corail qui entre en fleur, vous insulaires, vous aurez pour cela plus de facilité et de prépondérance que nous autres qui ne faisons que passer."

A letter from Dr. Smith, of Algoa Bay, announced his intention of publishing the Society's proceedings in the South African Quarterly Journal.

M. Mn. Sauzier, of Bourbon, wrote that the volcano of that island had several violent eruptions in November, December, and January, from two distinct craters. There was no flow of lava, as had been reported at St. Denis.

The president communicated the notes of M. J. Cameron, of Madagascar, relative to some minerals, particularly to an aerolite which fell on the Mozambique coast. Mr. C. announced that the Queen of the Ovas, Ranavalon Manzaka, had bestowed an annual donation of £60 towards the expence of a practical course of chemical lectures, which many of her subjects are already sufficiently educated to understand and appreciate.

Mr. Bernard, Proviseur du Collège Royal, and Mr. J. N. Casanova, D. C. M. were admitted honorary members of the Society. The latter presented his work entitled "Examen de las Aguas minerales de San Pedro, &c. 1827."



*Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of February, 1892.*

| Days of the Month. | Minimum Temperature observed at Sun-fire. |                     |                      |       | Maximum Pressure observed at 9h. 50m. |                     |                     |                      | Observations made at apparent Noon. |                    |                     |                     | Max. Temp. and Dryness observed at 2h. 40m. |       |                    |                     | Minimum Pressure observed at 4h. 30m. |                      |       |                    | Observations made at Sunset. |                     |                      |       |                    |                    |                    |      |     |
|--------------------|---|---------------------|----------------------|-------|---------------------------------------|---------------------|---------------------|----------------------|-------------------------------------|--------------------|---------------------|---------------------|---|-------|--------------------|---------------------|---------------------------------------|----------------------|-------|--------------------|------------------------------|---------------------|----------------------|-------|--------------------|--------------------|--------------------|------|-----|
|                    | Baromet. reduced to 32°.                  | Temper. of the air. | Depres. of M.B.Ther. | Wind. | Aspect of the sky.                    | Barom. red. to 32°. | Temper. of the air. | Depres. of M.B.Ther. | Wind.                               | Aspect of the sky. | Barom. red. to 32°. | Temper. of the air. | Depres. of M.B.Ther.                        | Wind. | Aspect of the sky. | Barom. red. to 32°. | Temper. of the air.                   | Depres. of M.B.Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°.          | Temper. of the air. | Depres. of M.B.Ther. | Wind. | Aspect of the sky. | Item Gauge, No. 1. | Rain Gauge, No. 2. |      |     |
| 1                  | 30.733                                    | 52.7                | 1.2                  | cu.   | ci.                                   | .065                | 67.                 | 12.1                 | n.w.                                | ci.                | .025                | 74.3                | 17.1  | n.w.  | ci.                | .073                | 77.8                                  | 18.3                 | w     | ci.                | .067                         | 77.                 | 15.1                 | w     | ci.                | .075               | 79.                | 10.1 | ci  |
| 2                  | .015                                      | 54.3                | 1.1                  | do.   | ci.                                   | .091                | 69.5                | 6.6                  | do.                                 | do.                | .050                | 75.3                | 17.3  | do.   | ci.                | .096                | 78.                                   | 19.3                 | w     | ci.                | .093                         | 77.8                | 13.4                 | n.w   | ci.                | .009               | 79.                | 10.1 | ci  |
| 3                  | .088                                      | 52.3                | 1.8                  | do.   | do.                                   | .130                | 69.                 | 10.3                 | cu.                                 | ci.                | .057                | 73.                 | 17.3  | do.   | ci.                | .093                | 76.6                                  | 20.3                 | do.   | ci.                | .063                         | 76.                 | 19.5                 | do.   | ci.                | .007               | 69.7               | 10.2 | cu  |
| 4                  | .015                                      | 55.5                | 1.1                  | do.   | do.                                   | .086                | 70.3                | 11.6                 | n.w.                                | ci.                | .097                | 73.                 | 16.1  | do.   | ci.                | .093                | 75.3                                  | 20.3                 | do.   | ci.                | .063                         | 76.                 | 17.3                 | do.   | ci.                | .071               | 72.                | 12.3 | do. |
| 5                  | .015                                      | 55.5                | 1.1                  | do.   | do.                                   | .040                | 71.                 | 4.8                  | n.e.                                | cu.                | .057                | 73.                 | 17.2  | n.e.  | ci.                | .093                | 75.3                                  | 20.3                 | do.   | ci.                | .063                         | 76.                 | 17.3                 | do.   | ci.                | .071               | 72.                | 12.3 | do. |
| 6                  | .020                                      | 55.5                | 1.1                  | do.   | do.                                   | .022                | 68.7                | 12.5                 | n.e.                                | ci.                | .059                | 76.7                | 17.5  | n.e.  | ci.                | .085                | 80.5                                  | 16.6                 | n.e.  | ci.                | .094                         | 79.8                | 14.3                 | n.w.  | ci.                | .050               | 72.3               | 6.4  | do. |
| 7                  | .080                                      | 57.3                | 5.7                  | n.e.  | do.                                   | .067                | 69.7                | 12.8                 | n.e.                                | ci.                | .046                | 77.3                | 15.6  | n.e.  | ci.                | .069                | 79.                                   | 17.1                 | n.    | do.                | .058                         | 78.7                | 17.                  | n.    | do.                | .093               | 72.                | 8.3  | do. |
| 8                  | .089                                      | 55.6                | 5.1                  | n.e.  | do.                                   | .081                | 69.                 | 13.5                 | do.                                 | ci.                | .046                | 77.3                | 15.6  | n.e.  | ci.                | .069                | 79.                                   | 17.1                 | n.    | do.                | .058                         | 78.7                | 17.                  | n.    | do.                | .093               | 72.                | 8.3  | do. |
| 9                  | .082                                      | 57.3                | 2.6                  | cu.   | do.                                   | .040                | 70.7                | 2.5                  | n.w                                 | do.                | .013                | 77.7                | 12.5  | n.w.  | ci.                | .091                | 80.3                                  | 12.6                 | n.e   | ci.                | .050                         | 77.5                | 11.3                 | n.w   | ci.                | .073               | 73.                | 4.8  | do. |
| 10                 | .013                                      | 63.5                | 1.6                  | do.   | ci.                                   | .080                | 70.                 | 5.1                  | do.                                 | cu.                | .055                | 82.3                | 10.6  | do.   | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 11                 | .081                                      | 67.5                | 1.3                  | do.   | do.                                   | .088                | 73.                 | 5.1                  | n.w                                 | ci.                | .053                | 82.3                | 10.6  | do.   | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 12                 | .097                                      | 63.3                | 1.6                  | do.   | ci.                                   | .051                | 77.3                | 11.6                 | do.                                 | do.                | .051                | 80.5                | 9.6   | do.   | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 13                 | .012                                      | 66.3                | 3.6                  | n.e.  | ci.                                   | .044                | 72.3                | 6.8                  | do.                                 | do.                | .051                | 80.5                | 9.6   | do.   | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 14                 | .079                                      | 69.6                | 1.8                  | n.e.  | ci.                                   | .053                | 77.                 | 9.3                  | n.w.                                | do.                | .052                | 81.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 15                 | .000                                      | 67.5                | 1.3                  | n.e.  | ci.                                   | .041                | 71.                 | 3.8                  | cu.                                 | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 16                 | .056                                      | 62.5                | 2.1                  | n.    | n.                                    | .007                | 62.5                | 1.                   | n.e.                                | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 17                 | .055                                      | 62.5                | 1.6                  | cu.   | cu.                                   | .056                | 67.3                | 3.4                  | do.                                 | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 18                 | .055                                      | 61.3                | 1.1                  | n.    | n.                                    | .108                | 69.7                | 5.9                  | n.                                  | do.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 19                 | .019                                      | 64.7                | 1.2                  | cu.   | ci.                                   | .073                | 72.7                | 7.8                  | n.e.                                | do.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 20                 | .051                                      | 64.5                | 6.3                  | do.   | ci.                                   | .087                | 70.7                | 11.                  | do.                                 | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 21                 | .061                                      | 64.5                | 1.3                  | cu.   | ci.                                   | .018                | 69.5                | 11.                  | n.                                  | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 22                 | .006                                      | 62.7                | 1.3                  | n.    | n.                                    | .083                | 70.5                | 5.6                  | w.                                  | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 23                 | .018                                      | 62.7                | 1.5                  | do.   | ci.                                   | .049                | 71.5                | 9.8                  | n.w.                                | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 24                 | .080                                      | 67.                 | 6.5                  | do.   | ci.                                   | .081                | 70.5                | 10.                  | cu.                                 | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 25                 | .076                                      | 64.5                | 1.7                  | n.w.  | ci.                                   | .051                | 69.8                | 4.9                  | n.                                  | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 26                 | .074                                      | 60.5                | 1.3                  | n.w.  | ci.                                   | .053                | 70.                 | 11.5                 | n.w.                                | ci.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 27                 | .085                                      | 65.                 | 2.5                  | cu.   | ci.                                   | .051                | 71.                 | 13.3                 | do.                                 | do.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 28                 | .041                                      | 56.5                | 2.4                  | do.   | do.                                   | .011                | 71.                 | 13.3                 | do.                                 | do.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| 29                 | .031                                      | 57.                 | 6.3                  | w.    | do.                                   | .059                | 74.5                | 16.8                 | w.                                  | do.                | .053                | 77.                 | 9.3   | w.    | do.                | .080                | 86.3                                  | 11.4                 | do.   | do.                | .056                         | 82.7                | 11.2                 | do.   | do.                | .081               | 79.5               | 8.1  | do. |
| Mean               | 29.943                                    | 61.2                | 2.7                  |       |                                       | .092                | 70.9                | 8.8                  |                                     |                    | .053                | 76.3                | 12.5  |       |                    | .085                | 79.8                                  | 14.4                 |       |                    | .057                         | 77.9                | 13.7                 |       |                    | .087               | 73.4               | 8.7  |     |

*Abbreviations.* In the column "wind," small letters have been used instead of capitals; *cu.* means cumulus. In the column "aspect of the sky," *cy.* is cloudy; *cl.* clear; *pn.* rain; *ci.* cirrus; *cu.* cumulus; *cs.* cirro-stratus; *cs. cumulo-stratus*; *cc.* cirro-cumulus; *n.* nimbus.





# JOURNAL

OF

## THE ASIATIC SOCIETY.

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No. 3.—March, 1832.

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I.—*Analysis of the Purānas.* By H. H. Wilson, Sec. As. Soc.

[Read at the Meetings of the Asiatic Society.]

1.—*The Agni Purāna.*

THE *Agni Purāna*, or more correctly, in a derivative form, the *Agneya Purāna*, is one of the eighteen principal *Purānas*. Although, in common with the other compositions so termed, it is attributed to *Vyāsa*, it is narrated as usual by his disciple *Sūta*, and was received by him from the *Munī Vasishtha*, to whom it was communicated by *Agni*, whence its denomination.

According to the assertion of its own text, the *Agneya Purāna* contains fourteen thousand stanzas; the *Bhāgavat* and other authorities give it 15,000 or 16,000. The copy to which this account refers, has about the former number.

The text is divided into a number of small sections, according to the subject, but without any enumeration: the number of them in the present instance amounted to 332. Colonel Wilford speaks of a supplement, and of a chapter, apparently the same, which he calls the 63rd, or last. The supplement, however, from which he derives his account of the modern princes of India up to the *Mohammedan* invasion, is no part of the work to which the name of *Agneya Purāna* is applied. It is clearly a distinct and subsequent composition.

The *Agneya Purāna* is interesting from the variety of the subjects of which it treats, and in which it deviates very materially from the definition given by its own reputed author of the contents of a *Purāna*. These *Agni* declares to be five: primitive creation; subsequent creations; the genealogies of demigods and kings; the reigns of the *Menus*, and the histories of royal dynasties. These however

occur but imperfectly in the body of this work, and the far greater portion of its contents is of a widely different character.

After the usual opening, the *Agneya Purāna* describes the ten *Avatāras*, and in the relation of those of *Rāmachandra* and *Krishna*, follows avowedly the *Rāmāyana* and *Mahābhārat*, being consequently posterior to those works.

The ensuing chapters relate to the worship of *Krishna*, as *Nārāyana* or *Vishnū*; this *Purāna* being of the *Vaishnava* class: at the same time it leans very favourably to the worship of *Siva*, as the *Linga*, and is full of *Tāntrika* ceremonies in honor of that form of the deity. It was compiled therefore probably anterior to any wide separation between the *Saiva* and *Vaishnava* sects, and it was undoubtedly prior to that modification of the *Vaishnava* faith, which pays such infinite veneration to *Krishna* as *Gopāla*, or *Govinda*, or *Bāla Gopāla*, the cowherd or the infant god; no allusion to whose worship has been found, nor has the name of his favourite mistress *Rādhā* once been encountered.

The ritual, including the ceremonies of the *Homa*, or burnt offering; the *Mantras*, or mystical formulæ; the *Mandalas*, or mystical diagrams; the *Pavitra*, or purificatory thread; the erection and consecration of temples, images, tanks, gardens, flags, jars, &c. extends through a number of chapters; it is in its general purport *Vaishnava*, but the *Linga* and several of the *Tāntrika* forms of *Durgā* are also especially revered; *Mantras* are abundantly introduced, as are the acts and gesticulations with which they are muttered or recited. The style in which they are narrated is however abrupt and obscure, and the ceremonial so confusedly and indistinctly laid down, that the whole has the appearance of a string of garbled extracts, rather than of a systematic detail. There is a general correspondence between these chapters with those of the *Sūreda Tilaka* and *Mantra Mahādadhi*, but it does not appear that they are identically the same.

This chapter is followed by the *Bhuvana Kosha*, (the description of the universe,) which corresponds generally with the same in other *Purānas*, but is much less explicit than in some of them. This chapter comprises the *Tirthas*, or places of pilgrimage, of which however it enumerates very few, and those but briefly. It is worthy of notice, that the *Nermadā* and *Sri Saila* are especially noticed, whilst the northern mountains are not mentioned, and also that Benares is called *Avimukta* in its religious character; whence it may be inferred, that the chief shrine was that of *Siva*, as *Avimukteswara*, not *Viswesara*, the form that has been most popular for some centuries at least. The

site of Benares was the same as at present, or between the *Varma* and the *Asi* rivulets.

The *Mūhātmyas*, or legends of the few *Tirthas*\* noticed, are very brief, except that of *Gayā*, which is so very minute, that it may be suspected to be an interpolation, as it is not in keeping with the rest, nor with the manner in which all such subjects are usually disposed of in a *Purānic* miscellany. Such interpolations or rather appendages are not at all uncommon, although the legends are more frequently attached to some of the other *Purānas*, as the *Brahmānda* and *Skānda*. We have, however, a case in point with the *Agni Purāna*; there being current in the South of India a work called the *Kāverī Mahātmyam* of the *Agni Purāna*, which is never found in the copies of the *Purāna* itself, and which indeed is very nearly as extensive as the whole work of which it is called a section.

The *Tirthas* are followed by the description of the Indian continent, and other portions of the world; also the distances and dimensions of the regions below and above it. The whole of this chapter has not been compared with other works, but in some passages, particularly the description of the sun's car, it is word for word the same with the text of the *Vishnū Purāna*: being in other respects, however, much less full and satisfactory than that work.

The description of the sun and planets leads to the astronomical or astrological section, and that to magical rites and formula; from these, the work proceeds rather abruptly to the periods of the *Manwantaras*, and then to the civil institutes of the *Hindū* caste, as birth, investiture, marriage, death, &c. the duties of the religious orders, and the contemplation of the deity, conformably to the tenets of the *Vedānta*: a long string of *Vratas* or religious obligations, both special and occasional, follows. The next subject discussed is that of gifts as religious duties, and this branch of the work finally closes with the description of corporeal austerities of a meritorious and pious complexion.

The next portion of the *Agneya Purāna* treats at considerable length, and with many interesting particulars, of the duties of princes, beginning with the ceremonies of their coronation, and comprehending their civil and military obligations; it forms what constituted the *Nīti* of *Hindū* writers, (Polity or the art of government,) and is of a character with which *Hindū* ideas have long ceased to be familiar. Some of the details correspond accurately enough with those that occur in a passage of the *Dāsa Kumāra*, and both are probably indebted to a common source: possibly the work ascribed to *Chānakya*, cited by the author of the *Dāsa Kumāra*. As the system is wholly unmixed with foreign notions,

and is purely *Hindū*, it can only relate to a state of things anterior to the *Mohammedan* invasion ; it is not a necessary consequence, it is true, that the *Agneya Purāna* should bear a similar date, but it is an argument rather in favour of such a belief, and contributes with other grounds to authorize such a conclusion, if not for the whole work, for a very extensive portion.

The like genuine *Hindū* character belongs to the sections that follow on the shape of weapons and archery, the phraseology and practice of which are no longer known. These sections of the *Agneya Purāna* are indeed particularly valuable, as they preserve almost, if not quite, singly, the memory of former regal and martial usages.

The chapters on the subject of judicature and law are so far curious, that they are literally the same as the text of the *Mitākshara*, ascribed to the *Munī Yajnyāwalkya*. The antiquity of that text is, in the estimation of the *Hindūs*, extravagantly remote ; but without reference to their belief, it is certainly not very modern, as passages have been found on inscriptions in every part of India, dated in the tenth and eleventh centuries. To have been so widely diffused, and to have then attained a general character as an authority, a considerable time must have elapsed, and the work must date therefore long prior to those inscriptions ; at the same time, this throws little light on the period at which the *Purāna* was compiled, the author of which might in any day transcribe the code of *Yajnyāwalkya*, although it is possible, that so undisguised a transfer may have preceded the time at which the legislative code was in general and extended circulation.

The chapters on law are followed by a rather miscellaneous series regarding the perusal of the *Vedas*, the averting of threatened ill-fortune, burnt-offerings, and the worship of various deities. We have then a short but curious chapter on the branches of the *Vedas*, and speaking of the *Purānas*, the following remarkable passage occurs : "six persons received the *Purānas* from *Vyāsa*, and were his pupils ; their names are *Sūta*, *Lomahersha*, *Sumati*, *Maitreya*, *Sinsapāyana*, and *Suvarni*." These, therefore, are probably the real authors of most if not of all the *Purānas*. It is said also, that *Sinsapāyana* and others compiled a *Sanhitā*, or epitome of all the *Purānas*.

The next chapter on gifts to be made, when the *Purānas* are read, contains the list of the *Purānas* and the enumeration of the stanzas they contain. In this respect many differences occur from similar enumerations in other *Purānas*, and the *Siva Purāna* is altogether omitted. With regard to the narrators and the chief subjects at least, in some cases, this detail varies from the text of the works as now found ;

these variations will be best noticed when we come to the respective *Purānas* to which they relate.

The list of the *Purānas* is followed by the genealogical chapters, detailing the families of the Sun and Moon, but more particularly the latter, and especially the houses of *Yādu* and *Puru*, to the time of *Krishna* and the *Pāṇḍavas*. These chapters agree generally with the dynasties usually detailed, but the lists are for the greater part very dry and abrupt, whilst few of the ordinary legends are preserved, and those so concisely as to be very obscure. There are some details relating to *Krishna* of a rather remarkable character. The time at which these chapters close leaves us no inference regarding the age of the compilation.

The next subject is medicine, taken avowedly from the instruction given by *Dhanvantari* to *Susruta*, or from the medical work attributed to the latter; the extracts are, however, very injudiciously made, with an utter disregard of method; and with a perverse selection of every thing least important: it also alludes to the classification of medicaments as hot and cold, and although it does not attach the same importance to the system as is given to it in *Mohammedan* medicine, yet its introduction at all, is rather in favour of its being derived from such a source, for it is not certain that the ancient writers *Charaka* and *Susruta* laid any greater stress upon these particular properties, than they are entitled to, without reference to a theoretical system. This part of the *Purāna* likewise includes much mystic medicine or curing by charms.

Another set of chapters on mystic rites and formulæ follows, and on the worship of different forms of *Siva* and *Devi*. The whole so incompatible with a *Vaishṇava* work that it is difficult not to suppose them additions by other and perhaps later hands.

Poetry and rhetoric form the next subjects, and conform to the systems usually received: the authority of *Pingala* is specified. The work concludes with a grammar, omitting the verbs: the system is that of *Panini* and *Kātyāyana*: the commentator on *Panini* is cited by name. The compilation is therefore posterior to the existence of the great body of *Hindū* poetical compositions, and to the consummation of the grammatical construction of the Sanscrit language.

From this general sketch of the *Agneya Purāna*, it is evident that it is a compilation from various works; that consequently it has no claim in itself to any great antiquity, although from the absence of any exotic materials, it might be pronounced earlier, with perhaps a few exceptions, than the *Mohammedan* invasion. From the absence also of a controversial or sectarian spirit, it is probably anterior to the struggles that took place in the 8th and 9th centuries of our era, between



the followers of *Siva* and *Vishná*. As a mere compilation, however, its date is of little importance, except as furnishing a testimony to that of the materials of which it is composed. Many of these may pretend no doubt to considerable antiquity, particularly the legendary accounts of the *Avatargas*, the section on regal polity and judicature, and the genealogical chapters: how far the rest may be ancient, is perhaps questionable, for there can be little doubt that the *Purána* as it now exists, differing from its own definition of a *Purána*, and comprehending such incongruous admixtures, is not the entire work as it at first stood. It is not unlikely that many chapters were arbitrarily supplied about 8 or 9 centuries ago, and a few perhaps even later; to fill up the chasms which time and accident had made in the original *Agneya Purána*.

## II.—On the Poetry of Madagascar. By the Revd. Mr. Baker.

[Communicated by C. Telfair, Esq. President of the Mauritius Nat. Hist. Soc.]

The most prominent characteristic of the Malagasy language, in reference to Poetry, is a total averseness to rhyme. Whilst it is admitted that the same identical sound is not legitimate rhyme, the extreme paucity of the language in terminations will ever preclude the introduction of rhyming verses. At least nineteen-twentieths of the whole vocabulary of words terminate in *a* or *y*, and an immense proportion of these in *na* and *ny*:—all other words terminate in *e*, or *o*, or the diphthongs *ay* and *ao*; and even these are exceedingly monotonous in the consonants of their penultimate and ultimate syllables. The best couplet I recollect to have heard has the rhyme of *hoë* and *më*, answering exactly to the English words, *way* and *may*, and the jingle of such a rhyme has in the Malagasy language an unnatural and harsh effect. In the genuine native verses I have not met with any such instance as the one specified, but have observed that rhyme of every description seems naturally from the true genius of the language, and intentionally from the uncouthness of its effect, inadmissible.

So far I have ventured to assert with confidence, and without any apprehension of future observation disproving my opinions:—but when the question arises, what then constitutes poetry or versification in Malagasy? I am conscious that uncertainty and error may very possibly attach to the opinions I shall present in reply. Future observation, combined with a more adequate knowledge of the subject, may disprove my present opinion, and substantiate what I at present reject

as destitute of proof. I make these remarks as introductory to the opinion that *quantity* (except so far as quantity and the number of syllables and accents may be regarded as necessarily synonymous) furnishes no rule for measuring Malagasy verses. No examples have come to my knowledge of lines having a credible claim to correctness, in which two apparently short syllables of one line are put to correspond with one long syllable of an equivalent line; but, where the number of syllables in a line exceeds those of a corresponding line, the metre is preserved by cutting off some syllables; and thence gliding two into one in reading, and by lengthening the half-syllables of verbal terminations into perfect syllables.

Every word in the language is strongly marked by one accent or more, corresponding in this respect with English. But in English it is observable, that the accent, falling on the vowel, leaves the syllable always long, and falling on the consonant, leaves the syllable short. I do not observe any similar distinction in Malagasy, excepting that there are a few words terminating in *ē* long, and thence carrying the accent. Probably in Malagasy the accented syllable is universally long, and the long syllable universally accented.

Granting the Malagasy verses to be divisible into feet and capable of being scanned, there is perhaps no instance to be found of a line corresponding with a line in Latin. In Latin, the number of syllables varies, and the last is deemed long; the reverse of these two cases is the fact with regard to Malagasy. Moreover the feet, constituting a line, seen to have no correspondence with the purest metres in Latin. Thus the most harmonious lines in Malagasy coincide syllable for syllable and accent for accent with the following:

|                            |                                   |
|----------------------------|-----------------------------------|
| "Tsŷ hitā nāo vā nŷ mātŷ   | Dost thou not see the dead        |
| Mārāinā tsŷ mbā māmīndrō." | Morning not warm at the fireside. |

Consisting of an amphibrach, trochee, and amphibrach. These the natives regard as the most harmonious lines; yet there are in the same ode lines quite different in respect to the situation of the accented syllables; as in the following couplet:

|                               |                                     |
|-------------------------------|-------------------------------------|
| "Tsŷ mähälälā hāvān' kō tōngā | Not knowing what kindred shall come |
| Aizā nŷ ōlōnā irēnŷ."         | Where are people as these?          |

Lines which, notwithstanding their diversity, do not appear essentially destitute of harmony.

These lines have more similarity to English, so far as that a certain uniformity of syllables and accent is essential in both languages; and

the harmony of the verse arises from the accentuation and the cæsure. The latter seems plainly discernible in Malagasy, as in this line :

“ Vāvahady hīl, rānā—misy hiāny,”  
(A door of entrance—that there is.)

Yet the verses are unlike to English in respect to their being destitute of rhyme, unaccented on the last syllable of a line, and scarcely, if ever permitting one line to run on in a continuous sense into another.

The characters peculiarly essential to Malagasy versification seem to be chiefly the following :

1. Harmony of syllables and accentuation ; a deviation from which rule produces a precisely similar harsh discordant effect on the ear as in English.

2. The expression must be diversified, and the words transposed, as in other languages.

3. Every line must be in some degree an independent sentiment ; or at least a clause of a sentence, bearing a natural division in the sense, and thence a pause of the voice in reading or singing. Hence the sense is often strikingly abrupt and laconic, as will be seen in the examples of literal translation.

The language abounds much in polysyllables ; there are exceedingly few monosyllables, and perhaps the greatest proportion of the words are of five syllables. Hence a line of eight syllables generally contains from two to five words, and a line of twelve is frequently comprised in four words. On this account a sentiment is rarely attempted to be set off with superfluous ornaments of language, but stands entirely on the merit of the figure under which it is conveyed. Of poetical adjectives, so often highly convenient in English for filling up the metre or adorning a graceless noun, scarcely an instance occurs in an entire song. Yet the language, thought, and style of the poetry is quite of a different cast from prose. Abounding in the boldest figures, and the sense left to connect itself by the chain of thought, it commends itself to the mind as the rude and unpolished offspring of poetical genius.

It is evident, that in a language so exceedingly different from English, combined with a state of society equally different, it is impossible, on the one hand, to give an intelligible literal translation, leaving the reader's imagination to fill up the images ; and on the other hand, it is difficult to give a vivid imitation of the original. For myself, I pretend not to any talent in poetical composition, and am induced to make the attempt merely by the novelty of the subject, until some more able pen shall display in language more worthy of its subject the gleanings of

orally preserved versification to be found in Madagascar. In the mean time, I have only to plead for all deficiencies, that I am not setting forth myself as an author, but only as a translator, and that from a language wherein nothing can be looked for rising above mediocrity, in the estimation of cultivated minds. I shall be abundantly requited for my trouble, should these contributions tend in any measure towards evincing that the native inhabitants of Madagascar, degraded as they actually appear, especially when contrasted with the enlightened population of civilized Europe, are nevertheless not destitute of natural genius, nor by any means insensible to the finer feelings and passions of human nature.

I ought not to conclude without observing, that there is a kind of composition very prevalent in the language which is neither perfect prose or poetry, but seems to form a connecting link between the two, being both in sentiment and expression more pithy, figurative, and smart than the former, and yet destitute of the metre, cadence, &c. of the latter. These pieces may be called poetical prose. A prose translation of such fugitive examples as have fallen into my hands would be dull and unstriking, and a *literal* rhyming translation impossible; so I have chosen in the accompanying example "on courtship," a translation pretty free in expression, but I believe perfectly correct, though somewhat paraphrased, in thought\*.

It appears, as far as I have discovered, that all compositions, in Malagasy, of a poetical turn of thought, are written in this style, except songs; the latter being the only compositions I have yet met with evidently written in regular metre.

The following, as well as several succeeding songs, are by a man called Razafiláhy, who happening to be a cripple, and unable to work, turned his attention to song-making, by which it is said he obtains a tolerable livelihood. He is a stoutish man, rides out on the back of a male slave, and has as buxom and merry looking a face as any to be seen in Madagascar†.

\* We are inclined to differ in opinion with our author on this subject, and to think that a mere literal translation with explanatory notes, would have better illustrated the peculiarities of thought and idiom in the Malagasy language, than even the best versified imitation.

† As more convenient for the generality of our readers, whom we may safely presume to be unacquainted with the Malagasy language, we have arranged the original text at the foot of the page, leaving the English version uninterrupted.—ED.

I.—*Literal translation of an Ode in praise of the Prince Rabodo. By Razañiláhy.*

Long, long, may live  
 Rabodonandrianampoina :  
 To the South is Ambatondrafandana\*,  
 To the North Ambobimitsimbina\*,  
 To the West Ambobimandrandra\*,  
 To the East Ambohijanahary\* ;  
 [He is] The full moon shining in the west,  
 The rising sun rising in the east.  
 Long live Rabodo,  
 Yea Rambóasaláma,  
 And Rakótosehéno na Radáma,  
 And his relations all,  
 Innumerable they ;  
 The portions of land shall then be dollars,  
 The corners of the houses guns ;  
 Endréhinantsiva is his portioned land,  
 Endréhinantsiva his house ;  
 Possessing much, yet not haughty.  
 Orphans shall then be plump [with health],  
 Their mother living, then they well fed.  
 Yonder is the defence of rock,  
 Yonder the clothing of wood,  
 A fence of spears, yea second fence of men,  
 Long live Rabodonandrianampoina.  
 A single tree in a lake—  
 It is not “ how many reign ? ”  
 For there is our only master.

I. *Ode in praise of Prince Rabodo.*

|                                 |                                      |
|---------------------------------|--------------------------------------|
| Hono re ny veloma               | Ny zoro n'trano dia basy             |
| Rabodon and rianampoina         | Endréhinantsiva ny tokotany ny       |
| Atsimo n' Ambatondrafandana     | Endrehinantsiva ny trano ny          |
| Avaratry ny Ambohimitsimbina    | Manambe tsy'mba miavona              |
| Andrefana Ambohimiandra         | Kamboty, dia dongadonga              |
| Atsinanana Ambohijanahary       | Velon'dreny dia botrabotra           |
| Volana tsinana ny avy andrefana | Ao ny miaketso vato                  |
| Feno manana ny avy atsinanana   | Ao ny miakanjo hazo                  |
| Veloma Rabodo                   | Rova lefona ka temitr' olona oindray |
| Sy Ramboasalama                 | Veloma Rabodonandrianampoina         |
| Sy Rakótosehéno na Radama       | Hazo tokana an-ory                   |
| Sy ny havany tontonlo           | Tsy firy no mandidy                  |
| Tsy tambo isaina,               | Ka tompo nay any ao.                 |
| Ny tokotany dia farantsa        |                                      |

\* Name of a village, which like all others in Imerina, standing on a hill, is a poetical object. These villages being conspicuous objects, lying to the North, South, &c. of Tananarivo, the prince's residence.

The following is the translation of another Ode by the same author.

II. *The Great River.*

Yonder Ambaniála's\* streams go forth,  
 Ambóhidrapéto† to the north extends,  
 To the northward also Ambóhitrimanjáka;  
 ‡ " Guide well thy winding course,  
 Nor kill the people's sons with heedless might.  
 Too full, thou'rt like an ill-cut cloak,  
 Smothering the head it should set off.  
 Dried up, thou'rt like an insufficient dress,  
 Leaving the breast and arms naked.  
 And thus from day to day  
 Thou rollest onwards continually.  
 Soon at Iki'opa are thy waters found;  
 Iki'opa renowned through the world,  
 Devouring all, yet still unsatiated||,  
 Lab'ring ever, and still thy work unaccomplished;  
 .Ambohiboánjo from thy bank not far,  
 And southward Soavinimérina;  
 Behold Antânta abounding in eels,  
 § From whence murmuring sounds are heard;  
 The soldier here casts round his wandering eye  
 Thinking of distant friends.  
 Here thou art in jeopardy, new-wedded bride,  
 Should a dispute arise towards the evening;  
 For caprice controls the unsettled heart.  
 Discarded, thou wilt soon retrace thy steps!  
 But we again pursue the river's course

II. *Anonibe.*

Indro ny rano Ambaniala  
 Avaratr' Ambohidrapeto  
 Avaratr' Ambohitrimanjaka  
 Mahaiza mandeha  
 Mahaiza nizotra  
 Aza mamono zana' bahoaka  
 Tondraka, toa misaron' doha  
 Ritra, toa manao sikimbalaka  
 Ka ny azy re toetr' andro ny  
 Ka mivalambalan' indray  
 Koa man kany Ikiopa

Ikiopa rano malaza  
 Homambe fa tsy voky  
 Mivalambalan' indray  
 Mivalana dia any Ambohiboanjo  
 Any atsimo ny Soavinimerina  
 Indro koa re any Antonta  
 Ka migodongodom' piteny  
 Mahita anay lavi'kavana  
 Miady, mena masoandro  
 Ka tsy fantatr' ompanavao  
 Tsy vatra n'olona tsy honina

\* This and others are names of villages lying far above the banks of the river..

† The whole beauty of the poem lies in a hidden allusion running through it to the kingdom; here perhaps is an admonition to the sovereign.

‡ All other streams run into Ikiopa.

§ That is, the sound of the distant waterfall, and by allusion, the repining of the soldiers going to war.

At Farahantsana next abide :  
 The people there with noisy long guns fire,\*  
 And cannons, longer, and still more noisy :  
 Spitting the frothy foam and rising phlegm  
 Writhing in restless agony and pain†  
 ' Let each unwept forsake his best beloved!  
 For all partake the bitter curse.‡

III. *Paraphrase of a poem called Ny Momba, or the Barren. By the same Author.*

1 To thee who dost all childless live,  
 'Thou barren, this advice I give ;  
 ' In place secure thy wealth with foresight lay ;'  
 For then a thousand tongues thou'lt find to say,  
 " Kind father, dearest mother, thou to me :"  
 No space their coming stays,  
 No rugged road delays.  
 But if thou pine in wretched poverty ;  
 Not thine gay robes to wear,  
 No flattery soothes thine ear,  
 No prattling babes entwine,  
 No equal portion thine.

Izahay re dia handeha  
 Ka tonga tany Ifarahantsana  
 Ka ny ao mepoa' hazy lava  
 Ny ao mipoa' tafondro lava

Mitsipidrorra mivalana  
 Mamoiza ny manan' malala  
 Fa samy efa nozoi'ny.

III. *Ny Momba.*

1 Izany Rakala momba,  
 Telirizo trara ny harena ;  
 Fa raha misy ireny,  
 Atao ny hoe, ikiaky nao, ineny ;  
 Tsy nahalavitra ny tany,  
 T-y mabasasa' mandeha,  
 Fa raha tsy manana ireny,  
 Lany haingio,  
 Lany laingia,  
 Lany zanaka.  
 Lany zara.

2 Momla lany havena,  
 Ny maso no apitrapitra ;  
 Tsy misy havan' kamangy,  
 Tsy misy zaza hitomany.  
 Noana, tsy manan' kangatahana ;  
 Voky, tsy manan' kotolorana ;  
 Marary, tsy manan' kitsabo,  
 Sasatra, tsy manan' kitsetra.  
 Eny Ramomba,  
 Maty, tsy manan' kitomany.

\* Literally true of the Sakalava enemy, and figuratively of the water-fall, Ifarahantsana.

† Under the figure of the dashing of the water, alluding to the death of soldiers through war, fever, and famine.

‡ Every family has lost some relations in the devastating wars, and all must submit without repining.

2 The barren destitute of wealthy store,  
 Extends her wandering eyes the wide world o'er.  
 No loving friend to visit her is found,  
 No children, prattling all their wants, surround.  
     If hungry, none a scanty dole shall mete;  
     If satiate, none the falling crumbs shall eat ; \*  
     By none thy sufferings are allayed ;  
     If weary none shall give thee aid ;  
     And, hapless, even when thou'rt dead,  
     No tears shall weep o'er thy last bed.

3 Thy shroud not half a dollar buys,  
 Nor sixpence sheep for sacrifice,  
 A penny pays for grease to light  
     Instead of taper thy sad ghost ;  
 No friends shall watch the dreary night  
 To shallow grave shalt thou be hurried,  
 And with regardless haste be buried,  
     A farthing all thy funeral cost.  
 " Ah ! 'mother, life is misery."  
 Yea barren, such thy fate must be.  
 Thou'lt fain the locust\* catch, for whom ?—  
 For children of a luckier womb,  
 Yea such, ill-fated barren, is thy doom.

4 Now barren, view thy husband's bed,  
 And thou from parent's distant bed ;  
 From head to foot sorrow's own image thou,  
 Unheard by all, thy sad bewailings now.  
 Ah ! barren, thou in former days,  
     A father living,  
     A mother giving,  
 Couldst bathe in water fetch'd by slaves,  
 Caressed and blest in all thy ways.  
 Ah barren, now how chang'd thy state,  
     Thy father's life-dream o'er,  
     Thy mother now no more,  
 To bathe in tears thy wretched fate,  
 All cloth'd in rags, thou once mightst hate.

3 Vitan' damban' doso,  
 Vitan' ondryn' tsikiajy ;  
 Vitan' tsabora mila voamena,  
 Atao ny lavenan' tandrevaka.  
     Tsy misy mpiaritory,  
     Ialany ny olo kajia ;  
     Maty re aho raneny ;  
     Izany Rakala momba  
     Misambo' balala  
     Ho an' janak' olona ;  
     Eny Ramomba

4 Rakala momba, momba ka maty vady ;  
 Ka lavi' dray aman' drengy ;  
 Sady an-dolia no an-tongotra.  
 Miantso ka tsy fantà' ny,  
 Ray bado, ray b.do ;  
 Fahavelon' dro ray ney,  
 Fahavelon' dro reny ;  
 Mandro rano antsakaina ;  
 Raha mivoaka, tambatambazana ;

\* The poor among the people eat the locusts, and feed their children with them.



Link'd to some churl, I see in piteous plight  
 Thee pinch'd and waken'd at the morning light ;  
 Expell'd the cheering hearth, thy wedded right,—  
 " Ah, mother, life is misery ;  
 Would I had died in infancy !"

- 5 I travel'd eastward succour to obtain ;  
 My father's kindred live hard by.  
 Alas ! I'm chang'd ; they know me not again ;  
 Ah mother ! like the dead am I.  
 I turn'd my steps into the northern way ;  
 My mother's kindred live hard by.  
 Alas ! I'm chang'd ; thou'rt not the same, they say ;  
 Ah mother ! like the dead am I.  
 I turn'd me back again, and southward ranged ;  
 My father's sister lives hard by.  
 But she like all my relatives is changed.  
 Ah mother ; worse than dead am I.  
 I turn'd again a westward course to tread ;  
 'Tis there my mother's sisters live.  
 Their dead relation's awful blame they dread,  
 So careless pitch the boon they give !

IV. *Paraphrase of an Eclogue in Poetical Prose.*—Author unknown.

*On Courtship.*

- She. Pray tell me, since you oft profess  
 Your fervent love to me ;  
 To what, if we may give a guess,  
 Your love may liken'd be.  
 He. Rice which affords our daily food,  
 And constant life supplies,  
 Is the best emblem of my love,  
 Which never never dies.  
 She. Ah no ! not so thy love to me,  
 For that, thou deemest sweet,  
 Only when hunger presses thee  
 To take the proffer'd meat.  
 Then tell me, since you oft profess  
 Your, &c. (as in the first verse.)

|                                     |                                |
|-------------------------------------|--------------------------------|
| Ray bado, ray bado ;                | Nony nankao avaratr' aho ;     |
| Raha maty rô ray ny,                | Havan' dry neny no ao.         |
| Raha maty ro reny ;                 | Nova'ny ny olon' kafa ;        |
| Mandro rano maso                    | Maty aho rey neny              |
| Mitafy lamba tseroka,               | Noney nankao atrimo aho ;      |
| Mitoetra any ny olona ny bado,      | Zanak' olomianadahy no ao.     |
| Mandry maraina, rongadrongati' ny,  | Novany fabatelo be ;           |
| Mamindro, atositosi' ny ny sasany.  | Maty aho rey neny.             |
| Maty aho ry neny,                   | Nony nankao andrefan' aho,     |
| Tsy maty fony kely.                 | Zanak' olona mirahavavy no ao  |
| No ny nankaoa atrinanana aho ;      | Ny tao no manipy kely,         |
| Havau'dry kiaky no ao.              | Fa matahotra ny tsiny ny maty. |
| Nodidany ny olona tsy fantatra aho, |                                |
| Maty aho ry neny                    |                                |

- He. I love you as the fountain pure,  
Which yields a sure supply  
Of that, without whose aid secure  
My frame would quickly die.
- She. Ah no ! not so thy love to me,  
For that, when dirt adheres  
Which others scornfully may see,  
Desirable appears.  
Then tell me, &c.
- He. The lamba\* which around I fold  
To guard life's vital flame,  
Is that, which, next to thee I hold  
Most needful to my frame.
- She. Ah no ! for that when older grown,  
Disdain'd, thou wilt reject ;  
And ne'er again will it be known,  
But lie in long neglect.  
Then tell me, &c.
- He. I love thee like the luscious taste  
Of a new honey-comb,  
Whose precious fruit is seized with haste,  
And borne in triumph home.
- She. Ah no ! for there amidst the sweets,  
Though luscious they be found ;  
The goodness not unmingled meets,  
But dregs impure abound.  
Then tell me, &c.
- He. I love thee as the sov'reign king  
Of this our native land ;  
Whose endless praises all can sing,  
Whose word moves every hand.
- She. To this, in truth, thy love compare,  
Whose merely passing by,  
Rebuking every vulgar stare,  
Abashes every eye.

#### IV. *On Courtship.*

Tia nao tabaky n'inona angaha aho ? Tia ko tabaky ny vany hianao.—Tsy tia nao aho izany, fa atao nao famonjy fo raha noana. Tia nao tahaky n'inena angaha aho ?—Tia ko tahaky ny rano hianao.—Tsy tia nao izany aho fa atao nao fitia momba tseroka. Tia nao tahaky n'inona ary aho ? Tia ko tahaky ny lamba hianao.—Tsy tia nao aho izany fa raha tonta afindra nao ka tsy tsaroa 'nao intsony. Tia nao tabaky n'inona angaha aho ? Tia ko tahaky ny tantely hianao. Tsy nia nao aho izany, fa misy faikana. Tia nao tahaky n'inona angaha aho ? Tia ko tahaky ny Andriamanjaka hianao. Tia nao tokoa aho izany, mandulo, mahamena' maso mijery, mahamenatra :—Tia nao takoa aho izany, fa tapi'java' nirina aho, tapi' java' naleha.—Tia ko tahaky ny kiaky sy neny hianao : aelena, iray trano ;—maty, iray hazo.

\* The garment which a Malagasy wraps round his body, and which constitutes his only clothing, except what is wrapped round the loins ; and without which he is called naked.

To him, indeed, thy love compare,  
 Whose briefest, transient gaze,  
 With shame o'erwhelms, and deep despair,—  
 Or drooping hearts can raise.  
 To this, indeed, thy love compare,  
 I, of desire the end  
 And goal ; wherever you repair,  
 Still towards me you tend.  
 And I, my love to thee will prove,  
 In all good faith and truth,  
 A filial daughter's tender love  
 To parents of her youth.  
 Enjoying life, while life shall last  
 One house our common home ;  
 And when the mortal scene is past  
 United in one tomb !

III.—*Extracts from Dr. Royle's Explanatory Address on the Exhibition of his Collections in Natural History, at the Meeting of the Asiatic Society, on the 7th March.*

*Geology of the Dehra Dûn.*

The low range of hills skirting the Himalaya has a strip of jungle along its south-west base, and the valley of Dehra on the north-east. The highest peaks of this range are probably 3000 feet above the level of the sea, and its outline presents a serrated appearance. The lower strata are composed of a loose-grained sandstone, above which are layers of clay, and gravel-rolled stones are found on the highest peaks ; the clay gravel and sandstones are all regularly stratified with the strata dipping to the N. N. E. at an angle of about 30°. From many of the rolled stones being found with their flat sides and long ends parallel to each other, though in different strata, and yet inclined at a considerable angle towards the horizon, it is evident, that they must originally have been deposited in horizontal strata, whence they have been raised into their present inclined position by some subsequent convulsion of nature.

The whole of this range, like the greater part of the plains of India, is impregnated with carbonate of lime ; for frequently where the water percolates through the rock, and a favorable situation offers, stalactites are formed, as well as tufaceous limestone, and it is more than probable that the *kankar* of the plains is similarly formed. Lignite was discovered in this range by Captain Herbert, and by Lieutenant Cautley, of which an account has been given by the above two gentlemen. A

writer in the *Bulletin des Sciences Naturelles* concluded, that this range was analogous in formation to the *Molasse* of the Alps. My friend and successor Dr. Falconer, without any knowledge of the opinions of this author, determined on his first visit to the *Kheri Ghát*, that this range was analogous to the *Nagelfluhe*, or *Molasse*, which is equivalent in age to the oldest of the tertiary series of English formations, or plastic clay, together with the London and Paris basons.

The valley of Dehra is elevated 2000 feet above the level of the sea, and is filled up with diluvial debris from at least 220 feet depth below the surface, as is indicated in the particulars of the strata discovered in the sinking of a well shaft by the Honourable Mr. Shore, detailed in the *GLEANINGS OF SCIENCE*, I. 164.

#### *Discovery of Fossil Bones.*

Dr. Falconer, in a letter received only a few days since, informs me, that he accomplished the tour alone, which we projected to have made together, for the purpose of visiting the place where the *lignite* is found in largest quantities. He communicates the very interesting and important discovery of fossil bones at that place: "I returned loaded, not only with lignite, but with *noble fossils of the monsters of the deep! bones of crocodilidæ, fragments of the skull of large turtles, and a fragment of a bivalve shell as large as an oyster.*" The identification of the range will therefore be certain, and we may expect an interesting paper on the subject from Dr. Falconer. It will be most curious to ascertain whether this deposit of organic remains is identical with the sources of the *bijli ke hár* to the north of the great chain of mountains, separated by the up-heaving of the latter; and, moreover, whether both formations are not connected with those of the Irawadí, so productive in magnificent specimens of organic reliquæ.

#### *Hour of Maximum Temperature in the Hills.*

One peculiarity in the hill climate is the early period of the day at which the maximum of heat is attained. In the plains we know, that if horary observations are taken, we find the temperature of the air goes on increasing until 2 or 3 p. m. In the hills, on the contrary, if the same kind of hourly observations be taken, and a fine clear day be chosen, the thermometer will be found to rise rapidly from sun-rise until 10 a. m. when it nearly attains the maximum; the increase after that hour does not amount to more than a degree or so. As the latitude is nearly the same as that of Seháranpúr, the power of the sun's rays and the quantity of heat communicated in a given time, must be nearly the same: but in the plains it is allowed to

accumulate; in the hills, on the contrary, some power must exist which carries off a portion of the heat as rapidly as it is communicated: this power is the breeze which is found daily to set in from the plains towards the hills, which commences about 10 A. M., (the very time after which so little increase takes place in the temperature,) and passing over the top of the range prevents the accumulation of any heat. It might appear, however, that as the atmosphere is heated to so high a degree in the subjacent plains, the effect of a breeze setting in that direction would be rather of a heating than that of a cooling nature; and it would be so, but the air as it ascends becomes less dense, and in proportion to this diminution of density is its capacity for heat increased, so that it is enabled to absorb all that which was sensible to the feelings, or was observed by a thermometer, in the plains; and thus, when it arrives at the top of the range, it feels cool and refreshing. At night a similar but more gentle breeze sets in from the hills towards the plains, and the two may with the strictest justice be compared to the land and sea breezes of the coast.

*Vegetable Impressions of the Coal Strata.*

On my way to Calcutta by dāk, I visited the coal mines of *Chinakūrí* and *Rániganj*, and procured a large collection of vegetable impressions, but I have not yet had time to ascertain whether there be any thing new among the number, though I am inclined to think, that the straight and striated unjointed reed was not among the specimens I saw with Dr. Falconer or the Rev. Mr. Everest. In travelling along the road after collecting these impressions, it struck me, that as the theory of the formation of coal supposes the existence of vegetables in swamps or *jhils* of a former period of the world, at which time many phenomena indicate a high degree of temperature, considerable assistance might be derived in confirmation or refutation of this theory, by examining the plants which now exist in the *jhils* of India, and comparing them with the vegetable impressions which distinguish the coal bason. The subject would lead me into too much detail now, but I hope to be able to follow it up at some future period. It may be cursorily remarked, that all the peculiarities stated by Mr. Conybeare as marking the vegetation of coal fields, may I think, be observed in the vegetation which now floats on the surface of the *jhils* round Calcutta. Their peculiarities are, 1, great length of stem; 2, deficiency of bark; 3, want of consistence in the woody fibre; 4, striated appearance of stem; 5, its frequently jointed nature, with great inequality in the length of the joints; and 6, the absence or smallness of roots. The *Mentha verticillata* displays itself many of these peculiarities: a resemblance

to the vegetable impressions now on the table may be observed, in the small collection of specimens of plants from the *jhils* of the neighbourhood, in my herbarium.

*Contents of Natural History Collection.*

The packages I am taking home, contain skins of most of the animals of the Upper Provinces and of the hills. The Alpine hare, *Pica* of Buffon, now formed into the sub-genus *Lagomys*, is perhaps the only novelty, as I do not recollect its being enumerated as occurring in the Himalaya in Griffith's Animal Kingdom, the latest systematic work on the subject. The hill fox is nearly twice as large as that of the plains, and in colour and general appearance bears considerable resemblance to the English fox. The drawings of the *Rokar*, or barking deer, and *Dúdhú*, as well as of the Cashmerian goat, may be interesting.

Of the specimens of birds, it may be sufficient to indicate the number of species comprized in the collection.

|                                |             |
|--------------------------------|-------------|
| Of the Accipitrine tribe,..... | 29 species. |
| Passerine, .....               | 115         |
| Scansores or climbers,.....    | 35          |
| Gallinaceous birds,.....       | 26          |
| Grallæ,.....                   | 36          |
| Anseres, .....                 | 21          |

In all 233 species.

The pheasants, wood-peckers, jays, shrikes, cuckoos, and the falcon tribe, are most numerous in species; the waders and anseres are incomplete, from the difficulty of procuring specimens.

Among the insects of the hills, many genera correspond with those of Europe. The species and genera of shells agree entirely with those described by Mr. Benson, at a late meeting. The above are only a few indications of the Natural History of the northern provinces of India; much remains to be done to get any thing approaching even to a correct Natural History of any of the provinces of India, and it is to be hoped, that many are employed in collecting materials towards the completion of this very desirable object.

*Vegetable Philology.*

*Lycium*.—From the roots of different species of barberry, an extract is prepared, which is well known throughout India by the name of *rasót*. In the Persian works on materia medica, *lúfion* is given as the Greek name of *rasót*. This is no doubt intended for the *λυκίον* of Dioscorides, I. 133, as the Persian account is a pretty literal translation of the Greek one, and Dioscorides moreover describes the mode of

making the extract and the plant from which the Indian *λυκιον* is manufactured. Sir J. Smith, in Rees' Cyclopædia, mentions that *Rhamnus infectorius* (Turkey-berry, Buckthorn) is justly considered by Dr. Sibthorp, as the *λυκιον*, *lycium*, of Dioscorides. Under the head of *lycium* however he says, 'the description given by that author does not accord entirely with any known species of *lycium* : ' that it was not always so, I conclude from finding that *Lycium Creticum* of Prosper Alpinus is a synonyme of *Berberis Cretica*, which is the Cretan or box-leaved Barberry. Considering, therefore, that a species of barberry was formerly called *Lycium*, and that an extract is now prepared from a species of barberry, to which the Greek name *lyfyon* is applied by the Persian writers, and that the Persian *ف* (ف) may with the greatest ease be substituted for *k* (ق) through the inadvertence of transcribers in writing a foreign word, I think it may safely be assumed that for *لوفيون* *lyfyon*, we should read *لوقيون* *luckyon*, and that consequently the *λυκιον* of Dioscorides is the *rasôl* of India, and that the extract was then, as it is now, prepared from a species of barberry.

*Peganum Harmala*.—This plant is called *hûrmal* by the native lakims, and commonly *isband Lahorî*, on account of its being brought from Lahore. It is remarkable, that Dioscorides gives *αρμαλα*, Harmala, as one of the synonymes, and *μολυ*, Moly, as another. In the Persian works, *hurmāl* is said to be the Syrian name, and *moly* the Greek. The plant is now common about Agra, having probably been introduced from the northward.

#### IV.—On the Utility of Cess-pools in Calcutta.

The accompanying memoranda of observations have been made at different towns and places, on experimental Cess-pools, or receptacles for filth, in use since last hot-weather.

The subject is not one of an attractive nature ; there are, however, some circumstances stated which may induce you to give the papers a place in your journal.

The wells that are spoken of in the papers were of perfectly simple and firm construction. They were dug to the greatest depth that the common well-diggers of the country could easily reach, and generally of the greatest breadth, for which *paats* or earthen-ware hoops can be made, viz. 4 feet 6 inches. A parapet of masonry was raised to the height of 4 or more feet, having the same cylinder as the wells, to obviate inconvenience from their overflowing. They have been dug either in the godowns, where conveniences on the old plan already existed, or in

open spots, where they have been properly inclosed and covered. The average expense of constructing the largest sized wells is Rs. 50, small ones can be completed for 15 or 20 Rs.

The well in No. 2, Hare-street, affords a good example of the utility of the plan. It was constructed to receive the washings of the cook-room. For 9 months it has perfectly succeeded, not the slightest smell having ever been perceptible from it; the water in it has stood a few inches only above the water in a neighbouring well of pure water, and the nuisance created by a stream of black fluid, that used to issue from the aperture of the cook-room, and travel, or attempt to travel, some hundred feet through the compound into the public surface drain, has been completely removed.

This is an experiment which may perhaps attract attention; by the same means the occupants of large premises may provide a remedy for a serious inconvenience, that the best conceivable plan of general drainage would very imperfectly reach. The expense of the well was only 19 Rs. Besides the wells adverted to in the annexed papers, there are many others that have long been used in private houses, both in the town and suburbs, with advantage.

In Fort William, and at Chinsurah, they have been greatly approved of, and are in constant use; the state of all has been carefully examined from time to time.

There are in the House of Correction two wells, one used by about 8 European prisoners, the other by about 100 natives. Not the slightest smell is perceivable from either of the wells themselves. The native one was also used as a receptacle for the filth accumulated in the prisoners' cells at night. This was too much for it. About the end of the rains it was nearly filled, and had to be shut up; the fluid in it gradually decreased, and has fallen up to this time to a level of 5 feet below the top; and about  $3\frac{1}{2}$  feet higher than that used by the small number of Europeans. A candle has been burnt in it without being in any manner affected.

In the Police Office, there are three wells; these have never been in any way offensive, and the light of a candle burnt in them has not been affected. The following is a report on the subject from Mr. McCann.

"I examined the cess-pools in the Police compound yesterday. The smell complained of, I found owing to an accumulation of filth in the corner, between the raised cylinder of the well and the walls of the godown, in which it (the large one) is placed. I found, on standing over the well itself, that no smell whatever proceeded from it.

"The depth of space free of water or filth in the well, No. 1, was about 3 feet; No. 2, 4 feet; and No. 3,  $4\frac{1}{2}$  or 5 feet, on the above date.



"I tried a candle in No. 1, it burned perfectly bright without any explosion."

In Mírjaní Galí, there are three of the same nature; these have been complained of by the division overseer, who thought they had not originally been dug of sufficient depth, but care must of course be taken that the platforms are kept carefully cleaned and washed.

On the 26th of September, 1831, the well in the cook-room of No. 2, Hare-street, raised  $3\frac{1}{2}$  feet above the surface, and having a small opening at top, for the passage of water, secured by a copper strainer, and in use from April, was examined.

There was not the slightest smell to be perceived from it, a candle was let down to the surface of the water without the flame being affected in the slightest degree; it burned as in a common atmosphere. The only effect it seemed to produce was the forcing out by rarefaction of a small quantity of the air in the well, which smelt offensively, but not very much so. The height of the water or filth was precisely the same as in another common well quite close to it.

The liquid at the surface of the water of the well appeared of the blackest and most filthy description; there were creatures like cock-roaches seen swimming among the bubbles, when they were disturbed by the iron to which the candle was affixed.

The following interesting account is given of certain phenomena observed in a kitchen cess-pool at Bythákkhaneh.

*Ignis Fatuus.*—On the 3rd of June, 1831, I caused a well to be dug at my garden, at the Bythákkhaneh, for the purpose of receiving the refuse water of my kitchen and bottlekhaneh, about twelve feet deep, (at which depth water was discovered,) and three feet broad.

The well was surrounded with the circular earthen *pauts* commonly used in the construction of wells in Bengal, and a pukka circular wall about two feet in height, built above the level of the earth, and the mouth of the well covered in with tile work and *khoah*, the same as a terrace, leaving an aperture to admit the refuse water about nine inches in diameter, closed by a copper strainer, to prevent particles of meat, rice, &c. falling into the well; but not fixed in the masonry, to allow the well to be inspected at pleasure.

The well was in constant use, for the before specified purposes, and the water in it has risen to nearly the level of the earth, in consequence of the rainy season, (when most wells in the vicinity of the Bythákkhaneh rise to within a few feet of that level,) and the quantity of refuse daily thrown into it.

On Tuesday evening, the 30th August, a little before gun-fire, the copper strainer of the well was blown off, and a blaze issued from the

aperture, (which several of my servants who were close to the well described as resembling flame produced by brimstone,) and covered both sides of the wall which separates the cook-room premises from those of the bottlekhaneh, and crosses with an arch over the well; it rose up in a sheet of flame to the top of the wall, and glided gently towards the door of the cook-room, and there vanished.

The servants, filled with dismay, came running to me, and reported what they had seen, on which I ordered a light to be introduced into the aperture of the well, which being done, it was instantly blown out, and a small blaze observed in the well near the aperture; but this effect did not take place on applying the light a second time. Next morning, on examining the well, it was found very offensive, in consequence, I believe, of my servants having contrary to my orders occasionally removed the strainer, and suffered rice and filth to enter the well, which was then in a state of fermentation, with rice visible on the surface. On examining the strainer, it had the appearance of having been scorched by fire.

After the alarm had subsided, a chokídar came forward, and stated that about fifteen nights previous to the event, he was on watch at the door of the bottlekhaneh at about mid-night, when he was alarmed by a similar appearance, which he did not mention, fearing he should not be believed.

I have since procured five pounds of chloride of lime, and mixed it with ten gallons of water, and poured the mixture into the well, which has nearly taken away every particle of offensive smell, and the well is now used as a receptacle for the refuse water of the bottlekhaneh.

A cess-pool in the yard of a very respectable coach building establishment in the town, seems to have shewn nearly similar phenomena to those reported of the cook-room cess-pool at Bytlákkhaneh.

It is of considerable depth, built in the form of a well, and continued about 5 feet above the surface of the ground. One day a candle was let down, to see what effect the foul air would have on the flame, and whether it would continue to burn: it reached about 3 or 4 feet, before there was any perceptible change in the light; it was then with a sort of flash surrounded with a blue flame about a foot in diameter, but this rapidly diminished till it disappeared altogether. The candle was now gradually lowered, and as it descended it burned more and more feebly, and had it not been drawn rapidly up it would have been quite extinguished. As the candle was drawn nearer the mouth of the cess-pool, it again revived and burned perfectly bright, about 4 feet from the top.

The gas which had caused the blue flame seemed now all exhausted, as there was not the slightest appearance of the halo which surrounded the candle on its being first let down. The candle was again lowered, but had no sooner reached the surface of the soil below than it was extinguished. •

The appearances above described are readily explained from the formation of carburetted and phosphuretted hydrogen from the decomposition of the vegetable and animal matter deposited in the wells: the heavy gas at the bottom was doubtless carbonic acid, formed by the combustion of the inflammable gases. The object of bringing the above facts to the notice of the public is to prove the great utility of the well system in a town situated like Calcutta, on a flat, and necessarily unprovided with common sewers. The experiment has been tried with success also in the barracks at Chinsurah and in Fort William, and in both the decomposition of the deposited matter is so rapid from the combined influence of the temperature and water, and from the multitude of living creatures which swarm within the wells, that there would, in ordinary circumstances or where the number of people resorting to them is moderate, seldom if ever be occasion to clean them out.

M.

V.—*On the Temperature and Saltness of the River Húglí, from Calcutta to the Sea.* By G. A. Prinsep, Esq.

Having had occasion to make frequent visits to Saugor Island, during the last four years, I usually availed myself of the spring tides, for greater expedition, and it was my practice to register the temperature and specific gravity of the river surface (the latter tried with a very sensible hydrometer) as I passed the Fort, Budge Budge, Fultah, and other principal stations both in going and returning, and especially to note the degree of saltness existing at the change of tide in whatever part of the river I happened to be. In this manner I have accumulated above 350 observations of temperature, and nearly as many of specific gravity, embracing all seasons of the year, but least copious in the rainy months. They may perhaps be worth recording, to assist the researches of some speculator in meteorological subjects, and to facilitate comparison with other rivers.

The following table contains a summary of the temperatures observed: the blanks of July have been filled up by estimate, in order to obtain a general mean.

TABLE 1.—Temperature of the River Hugli, from Calcutta to the Sea, through Channel Creek.

|   | Above Diamond Harbour. |        |         |       | At and below Diamond Harbour. |        |         |       | In Channel Creek. |        |                |       | Total No. of obs. | General mean. |
|---|------------------------|--------|---------|-------|-------------------------------|--------|---------|-------|-------------------|--------|----------------|-------|-------------------|---------------|
|   | No. of obs.            | hight. | lowest. | mean. | No. of obs.                   | hight. | lowest. | mean. | No. of obs.       | hight. | lowest.        | mean. |                   |               |
| January, 1830 and 1831, . . . . .               | 7                      | 71.    | 68.5    | 69.75 | 9                             | 70.    | 68.     | 69.   | 6                 | 72.    | 70. Md Pd. 68. | 70.   | 22                | 69.58         |
| February, 1829, 1830, 1831, and 1832, . . . . . | 29                     | 79.7   | 67.5    | 73.6  | 25                            | 80.    | 68.     | 74.   | 27                | 82.    | 69.            | 75.5  | 81                | 74.37         |
| March, 1829, 1831 and 1832, . . . .             | 10                     | 83.5   | 69.     | 76.25 | 15                            | 83.    | 69.     | 75.   | 12                | 84.5   | 72.*           | 78.25 | 37                | 76.83         |
| April, 1830 and 1831, . . . . .                 | 17                     | 88.    | 82.     | 85.   | 8                             | 84.5   | 81.     | 82.75 | 5                 | 85.5   | 83.            | 84.25 | 30                | 84.           |
| May, 1829, 1830, and 1831, . . . .              | 19                     | 90.    | 84.     | 87.5  | 12                            | 89.5   | 86.     | 87.75 | 11                | 89.5   | 86.            | 87.75 | 42                | 87.5          |
| June, 1822, 1830, and 1831, . . . .             | 13                     | 91.†   | 84.7    | 87.5  | 8                             | 86.    | 84.5    | 85.25 | 2                 | 84.5   | 84.            | 84.25 | 23                | 85.78         |
| July, 1830, . . . . .                           | 6                      | 88.    | 87.     | 87.5  | 0                             | 88.    | 85.     | 86.5  | 0§                | 88.    | 84.            | 86.   | 6                 | 86.67         |
| August, 1831, (30th and 31st), . . .            | 5                      | 85.5   | 85.25   | 85.38 | 2                             | 85.25  | 84.75   | 85.   | 5                 | 85.    | 84.75          | 84.87 | 12                | 85.08         |
| September, 1829, 1830, and 1831, .              | 5                      | 89.    | 84.5    | 86.75 | 7                             | 89.    | 86.     | 87.5  | 5                 | 88.5   | 86.            | 87.25 | 17                | 87.17         |
| October, 1829, 1830, and 1831, . .              | 11                     | 91.5   | 86.     | 88.75 | 7                             | 90.5   | 85.     | 87.75 | 16                | 89.5   | 84.            | 86.75 | 34                | 87.75         |
| November, 1829, 1830, and 1831, .               | 10                     | 84.5   | 76.5    | 80.5  | 8                             | 82.5   | 78.     | 80.25 | 10                | 84.    | 78.            | 81.   | 28                | 80.58         |
| December, 1829 and 1830, . . . . .              | 9                      | 74.5   | 70.     | 72.25 | 9                             | 74.5   | 71.5    | 73.   | 6                 | 76.7   | 72.            | 74.35 | 24                | 73.2          |
|   | 141                    | 84.68  | 80.47   | 81.71 | 110                           | 83.55  | 78.9    | 81.23 | 105               | 84.14  | 79.23          | 81.68 | 356               | 81.54         |

\* 28th February, 1831.—This is included, because, having quitted the Creek that day, I had no observations there in March, 1831, till the end of the month, when the lowest temperature was 81½.

† The observations of June, at and below Diamond Harbour, were limited to the 26th, 27th, and 28th June, 1831, to which may be added one made at Keclgere at 9 A.M. on the 10th June, 1822, after a violent storm, when the temperature of the river was 83½ at low water.

‡ At the Ferry off Pallán Ghat, 20th June, 1822, at 7½ A.M. half ebb.

§ The temperatures of this month, at and below Diamond Harbour, are filled up by estimate.

|| All the observations of November were made between the 1st and 9th, inclusive.

Hence it would seem that the mean temperature of the surface water exceeds  $81^{\circ}$  Fahr. every where between Calcutta and the sea. The absence of observations during stormy weather, may have given some trifling excess to the apparent result; but as the mean of each month is taken from the extremes, and I was upon the river immediately after several violent storms and during many north-westers, and registered the temperature at sun-rise, as well as during the day, I do not think the true mean temperature is lower than  $81$ . Indeed I should rather apprehend an error in the opposite direction; for in tropical countries I have remarked that the high temperatures, whether of the day, the month, or the season, are of longer duration than the low. A violent storm from the north has been known to depress the temperature to  $50^{\circ}$  Fahr. in January, at Vera Cruz (Lat.  $19^{\circ}11'$ ); but in a few hours it rises again above  $60$ : whereas for months together the temperature there exceeds  $80^{\circ}$ ; but, except on very rare occasions, never passes  $90^{\circ}$ . The mean of the extremes of the year would thus give a temperature of only  $70^{\circ}$  for Vera Cruz, while the true mean, according to different observers, is between  $79$  and  $81$ . In the climate of Calcutta, if we take the extremes at  $50$  and  $100$ , we obtain a mean of  $75$  instead of the true mean  $78$ ; and in the preceding table, the extremes of the year, ( $91$  and  $68$ ) give a mean  $79.5$ , two degrees lower than that of the months duly cast out. I have observed also, that, although a thin surface of water may occasionally be brought to the freezing point by radiation in the still clear nights of winter, the hottest sun will not raise it to  $110$ ; which gives a mean of only  $71$ .

It may seem extraordinary, that the temperature of a river should exceed that of the climate of the country through which it flows. I believe the reverse is generally supposed, on account of the cooling influence of evaporation, and I should take it to be so with the rivers of England. In tropical rivers, however, especially the Ganges, there is this peculiarity, that the whole, or nearly the whole supply is obtained at that season when the power of the sun is the greatest, and when the evaporation is very much reduced by the saturated state of the atmosphere. Hence the mass of waters has not time to cool very considerably, before the short winter is over; and when the sun begins again to act with power, their depth is at its minimum, and the sun's influence rapid in proportion. This difference of  $2$  or  $2\frac{1}{2}$  degrees is, however, not much more than Humboldt remarked within the tropics upon the ocean, which, except where influenced by currents, he always found to be warmer than the air immediately above it. We have an example of the same fact in the Bay of Bengal, which, at a short distance to the southward,

preserves a temperature above  $80^{\circ}$  throughout the year, sometimes reaching  $85^{\circ}$  and  $86^{\circ}$ . I found the surface of the sea off Point de Galle  $83^{\circ}$  on the 22nd December, and  $90^{\circ}$  in May; the mean of these is far above the medium temperature of the climate. Other examples I could cite to the same purport. The rivers of Mexico and the Orinoco reach the temperature of  $90$  when the temperature of the air is much below that degree.

The second table exhibits the specific gravity of the river water at four places, from actual observations made at different seasons. There will appear some discordance among them, from the accident of my passing places at different states of the tide, and consequently not obtaining the maxima and minima at each place on the same trip. To obtain any thing like exactness in ascertaining the saltness of the river in each month of the year, it is obvious, that daily observations should be taken for a long period at many stations and at every change of the tide. There is great inequality of season in this particular: on the 31st October 1830, the specific gravity off Mud Point was 1006.5 at high water spring tide; whereas, in 1831, so late as the 6th November, it was but 1001. at the top of the springs.

But, although the observations I have collected are not sufficiently numerous to afford an accurate mean for each or perhaps any one point on the river, they may be employed to form a table of the whole by estimate. To ascertain the influence both of the tides and of the freshes, —the latter at one season pushing the sea water quite out of the river channel, upon which in the other season it constantly encroaches, until the water at Mud Point becomes almost as briny as at the Sand Heads, and a slight degree of saltness is perceptible even at Calcutta,—I drew out a table of distances from Calcutta, and inserted in columns for every month (repeated for each year of observation) all the observations of high and low water, with a few others when those were deficient. This would be much too confused and voluminous for your pages; but it has enabled me to prepare the following (third) table, which, although formed by estimate, and not by actual averages, is not likely to be very wide of the truth: indeed, I scarcely think the errors exceed .001 in any place. The zero, at the head of each column, represents the point at which saltness ceases to be perceptible at high and low water spring-tides. It will be seen, that the sea water gains a little in September when the freshes are the strongest; this is owing to the great rise of the equinoxial tides, which in the autumn are much higher than those of March, the average level of the sea being 3 to 4 feet higher in September, than it is at the end of the north-east monsoon.

TABLE 2.—Specific Gravity of the River Hugli at and below Phaltah, as observed.

|                             | Phaltah.    |          |         |         | Diamond Harbour. |          |         |         | Mud Point.  |          |         |         | Ganga Sagor. |          |         |         | Total. | General. |
|-----------------------------|-------------|----------|---------|---------|------------------|----------|---------|---------|-------------|----------|---------|---------|--------------|----------|---------|---------|--------|----------|
|                             | No. of obs. | highest. | lowest. | mean.   | No. of obs.      | highest. | lowest. | mean.   | No. of obs. | highest. | lowest. | mean.   | No. of obs.  | highest. | lowest. | mean.   |        |          |
| January, 1830 and 1831,     | 3           | 1002.8   | 1000.5  | 1001.65 | 3                | 1003.2   | 1002.1  | 1002.65 | 3           | 1007.9   | 1005.   | 1006.45 | 3            | 1016.5   | 1015.4  | 1015.95 | 12     | 1004.17  |
| February, 1829, 1830,       |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| 1831, and 1832, . . .       | 3           | 1004.6   | 1000.   | 1002.3  | 8                | 1008.    | 1000.5  | 1004.25 | 6           | 1013.8   | 1008.   | 1011.9  | 7            | 1020.1   | 1014.2  | 1017.15 | 24     | 1008.9   |
| March, 1829, 1831, & 1832   | 1           | 0        | 0       | 1005.5  | 5                | 1007.5   | 1005.7  | 1006.6  | 4           | 1015.5   | 1010.   | 1012.75 | 5            | 1019.7   | 1018.5  | 1019.1  | 15     | 1011.    |
| April, 1830 and 1831, . .   | 2           | 1006.3   | 1004.7  | 1005.5  | 4                | 1012.2   | 1008.2  | 1010.2  | 3           | 1018.5   | 1013.7  | 1016.1  | 1            | 0        | 0       | 1020.3  | 10     | 1013.05  |
| May, 1829, 1830, & 1831,    | 4           | 1009.4   | 1004.7  | 1007.05 | 8                | 1012.    | 1009.6  | 1010.8  | 4           | 1020.3   | 1013.9  | 1017.1  | 6            | 1023.    | 1022.   | 1022.5  | 22     | 1014.39  |
| June, 1831, (25th to 28th), |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| neap tides, . . . . .       | 1           | 0        | 0       | 1000.2  | 2                | 1002.4   | 1002.   | 1002.2  | 2           | 1013.6   | 1009.1  | 1011.35 | 1            | 0        | 0       | 1022.   | 6      | 1008.94  |
| July, (by interpolation,)   | 0           | 0        | 0       | 1000.   | 0                | 0        | 0       | 1001.   | 0           | 0        | 0       | 1004.   | 0            | 0        | 0       | 1015.   | 0      | 1005.    |
| August, 1831, . . . . .     | 2           | 1000.    | 1000.   | 1000.   | 1                | 0        | 0       | 1000.   | 1           | 0        | 0       | 1020.   | *            | 0        | 0       | 1010.   | 4      | 1002.5   |
| September, 1829, 1830,      |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| and 1831, . . . . .         | 1           | 0        | 0       | 1000.4  | 1                | 0        | 0       | 1000.6  | 3           | 1001.7   | 1000.   | 1000.85 | 5            | 1013.5   | 1005.2  | 1009.35 | 10     | 1002.8   |
| October, 1828, 1829, 1830,  |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| and 1831, . . . . .         | 0           | 0        | 0       | 1000.   | 2                | 1001.2   | 1000.   | 1000.6  | 5           | 1006.5   | 1000.   | 1003.25 | 5            | 1013.    | 1005.   | 1009.   | 16     | 1003.21  |
| November, 1829, 1830, &     |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| 1831, . . . . .             | 1           | 0        | 0       | 1000.   | 4                | 1001.3   | 1000.4  | 1000.85 | 3           | 1001.8   | 1000.1  | 1000.95 | 7            | 1010.8   | 1009.   | 1009.9  | 15     | 1003.81  |
| December, 1829 & 1830,      | 1           | 0        | 0       | 1000.1  | 2                | 1001.6   | 1000.5  | 1001.05 | 3           | 1005.9   | 1004.   | 1004.95 | 4            | 1012.5   | 1012.   | 1012.25 | 10     | 1004.59  |
| Number of observations      |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| and their mean, . . . . .   | 19          | 0        | 0       | 1002.   | 40               | 0        | 0       | 1003.4  | 17          | 0        | 0       | 1007.47 | 11           | 0        | 0       | 1015.21 | 141    | 1006.86  |
| Extremes observed and       |             |          |         |         |                  |          |         |         |             |          |         |         |              |          |         |         |        |          |
| their mean, . . . . .       | 0           | 1009.4   | 1000.   | 1004.7  | 0                | 1012.    | 1000.   | 1006.   | 1           | 1020.3   | 1000.   | 1010.15 | 1            | 1023.    | 1005.   | 1014.   | 0      | 0        |

\* At the mouth of the Duragra, the specific gravity of the water in the neaps was 1001.7 at  $\frac{1}{2}$  ebb, and 1000.8 at low water, on the 31st August, 1831.

TABLE 3.—Estimated Specific Gravity of the River Hugli, from Calcutta to the Sea, through Channel Creek, at High and Low Water, Spring Tides.

| Place.           | Jan.   |       | Feb.  |       | March. |       | April. |       | May.  |       | June. |       | Aug.  |       | Sept. |       | Oct.  |       | Nov.  |       | Dec.  |       |
|------------------|--------|-------|-------|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                  | H. W.  | L. W. | H. W. | L. W. | H. W.  | L. W. | H. W.  | L. W. | H. W. | L. W. | H. W. | L. W. | H. W. | L. W. | H. W. | L. W. | H. W. | L. W. | H. W. | L. W. | H. W. | L. W. |
| 0 Calcutta,...   |        |       |       |       | 0.5    | 0.6   | 0.6    | 0.6   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 5 Garden Re.     |        |       | 0.1   | 0.1   | 0.3    | 0.3   | 0.6    | 0.6   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 10 Akra,...      |        |       | 0.1   | 0.1   | 0.3    | 0.3   | 0.6    | 0.6   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 18 Faibaj,...    |        |       | 0.5   | 0.5   | 1.0    | 0.2   | 2.0    | 0.8   | 3.0   | 1.0   | 0.2   |       |       |       |       |       |       |       |       |       |       |       |
| 22 Uiyabarya,    | 1000.5 |       | 1.0   | 0.2   | 1.5    | 0.5   | 2.5    | 1.0   | 3.5   | 2.0   | 0.4   |       |       |       |       |       |       |       |       |       |       |       |
| 24 Achipur,...   | 1000.6 | 0.1   | 1.2   | 0.3   | 1.6    | 0.6   | 2.7    | 1.1   | 4.0   | 2.5   | 0.5   |       |       |       |       |       |       |       |       |       |       |       |
| 27 Mayapur,...   | 1001.0 | 0.2   | 2.0   | 0.5   | 2.5    | 1.0   | 3.0    | 1.3   | 5.0   | 3.0   | 7.0   |       |       |       |       |       |       |       |       |       |       |       |
| 35 Phaltah, ..   | 1002.0 | 0.5   | 3.5   | 1.0   | 5.0    | 2.0   | 6.0    | 3.5   | 9.0   | 5.0   | 1.0   |       |       |       |       |       |       |       |       |       |       |       |
| 39 Damda R.      | 1002.5 | 0.7   | 4.0   | 1.5   | 5.5    | 2.5   | 7.0    | 4.0   | 10.0  | 6.0   | 1.5   | 0.5   |       |       |       |       |       |       |       |       |       |       |
| 43 Rôpnarain,    | 1003.0 | 1.0   | 4.5   | 2.0   | 6.0    | 3.0   | 8.0    | 5.0   | 11.0  | 7.0   | 2.0   | 1.0   |       |       |       |       |       |       |       |       |       |       |
| 50 Diamond H.    | 1004.0 | 2.0   | 6.5   | 3.0   | 8.0    | 5.0   | 11.0   | 7.0   | 12.5  | 10.0  | 4.0   | 2.0   |       |       |       |       |       |       |       |       |       |       |
| 60 Kalpi, ....   | 1005.5 | 3.0   | 5.0   | 4.0   | 11.0   | 7.0   | 14.0   | 10.0  | 15.5  | 12.0  | 6.0   | 2.5   |       |       |       |       |       |       |       |       |       |       |
| 65 Rangfalah     | 1006.5 | 4.0   | 10.0  | 6.0   | 12.0   | 8.0   | 15.0   | 11.0  | 17.0  | 13.0  | 8.5   | 5.0   |       |       |       |       |       |       |       |       |       |       |
| 70 Silver Tree,  | 1007.5 | 5.0   | 12.0  | 7.0   | 13.0   | 9.0   | 16.0   | 12.5  | 18.0  | 14.0  | 12.0  | 7.0   |       |       |       |       |       |       |       |       |       |       |
| 73 Mud Point,    | 1008.0 | 6.0   | 13.0  | 8.0   | 14.0   | 11.0  | 17.0   | 13.5  | 19.0  | 15.0  | 14.0  | 9.0   |       |       |       |       |       |       |       |       |       |       |
| 75 Young's P.    | 1009.0 | 7.0   | 13.5  | 9.0   | 14.5   | 11.5  | 17.5   | 15.0  | 19.2  | 16.0  | 15.0  | 11.0  |       |       |       |       |       |       |       |       |       |       |
| 80 Comt. Cr.     | 1011.0 | 9.0   | 14.0  | 10.0  | 16.0   | 13.0  | 18.0   | 16.0  | 19.5  | 17.0  | 16.0  | 13.0  |       |       |       |       |       |       |       |       |       |       |
| 83 Bhagwa K.     | 1012.0 | 10.0  | 15.0  | 12.0  | 17.0   | 14.0  | 19.0   | 17.0  | 20.0  | 18.0  | 17.5  | 15.0  |       |       |       |       |       |       |       |       |       |       |
| 87 Durgara...    | 1014.0 | 12.5  | 17.0  | 14.0  | 19.0   | 16.5  | 20.0   | 18.0  | 21.0  | 19.0  | 19.0  | 17.0  |       |       |       |       |       |       |       |       |       |       |
| 91 Arhai Ban.    | 1015.0 | 13.5  | 18.0  | 15.0  | 20.0   | 18.0  | 21.0   | 19.0  | 22.0  | 20.0  | 20.0  | 18.0  |       |       |       |       |       |       |       |       |       |       |
| 95 Sâ t Barkee   | 1017.0 | 15.0  | 19.0  | 17.0  | 21.0   | 19.0  | 22.0   | 20.0  | 23.0  | 22.0  | 22.0  | 20.0  |       |       |       |       |       |       |       |       |       |       |
| 97 Ganga Sâz.    | 1017.5 | 15.5  | 19.5  |       | 22.5   |       | 24.0   |       | 27.0  |       | 24.0  |       |       |       |       |       |       |       |       |       |       |       |
| 100 Edmondst. I. |        |       |       |       |        |       |        |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

The numbers in this Table, with the exception of the first column, are to be added to 1000 to express the specific gravity.

0 represents the point where the river water may be esteemed perfectly fresh.



## VI.—SCIENTIFIC INTELLIGENCE.

[Extracts from European correspondence, communicated  
by G. Swinton, Esq. Calcutta.]

I.—*Burmese Varnish.*

"I have long been putting off writing to you in the hope of being able to give you some intelligence regarding your black varnish, which I was in great hopes would have been considered an important acquisition to the arts. I have however been baffled in all my attempts to get what I should consider a fair trial made of its merits. All the artists employed in the varnishing and japanning business are so wedded to their common routine and to the manipulation of materials which are familiar to them, that I have found great difficulty in getting trials made, and have very little confidence in the statements made to me of the results. I am not losing sight of the matter, however, and have still hopes of getting a trial made on a considerable scale by a great house at Birmingham. The managing partner of this house honestly told me, that although a better varnish than that which they now use were to be offered to them for nothing, they could hardly bring it into use, if it presented any considerable difficulties in its application, as that which is now prepared from Coal-tar, besides being so cheap (2s. per gallon), is easily worked, and produces the most beautiful skin imaginable. The beauty of the higher kinds of papier-maché ware is now very remarkable, and except in some of the gold ornaments, surpasses the best specimens of Chinese manufacture. It has occurred to me that canvas prepared in this way with your varnish would make indestructible grounds (as far as damp is concerned) for oil paintings.

A varnish has been discovered at Paris, which is used for preparing canvas and oak for painting on; it is of a most durable nature, and is sold in prepared squares of any dimensions.

2.—*Fishes of the Ganges.*

"I spent some time in Paris this summer, and saw a good deal of M. Cuvier. I used the freedom of mentioning your name to him, and your desire of taking advantage of your position to forward the interests of science. I asked him if there was any particular object in natural history which I might suggest to you as a desideratum, which could be supplied from India. He immediately replied emphatically, "Ah certainement, les poissons d'eau douce;" he added that some gentlemen in Calcutta had already sent a good many of those of the lower rivers and parts of the country, but that they had no accounts of those of the higher parts.

3.—*Carton-pierre.*

Along with this I shall send a packet containing some letters, which I have received from persons with whom I had correspondence about your specimens. I have added one which I got a few days ago from a civil engineer now in Paris. It contains some account of a substance (Carton-pierre), which I think peculiarly calculated for forming ceilings for Bangalos, and even for the best pukka houses in India; it forms pannels or compartments of any size, and could with great ease be put up between the beams of the ceiling. The art of making the carton-pierre was lost in France for 300 years: it is as white as marble, but much lighter; there are some curious accounts of it in the Memoirs of the Academy of St. Petersburg. Its composition is kept a secret here. The following is extracted from a French journal.

"L'art d'exécuter en carton des ornemens de cette substance florissait en France au seizième siècle. La perfection à laquelle il était parvenu à cet époque est attestée par les beaux plafonds qui décoraient au Louvre les appartemens du Roi Henri II.

Cet art se perdit ou du moins restait dans l'oubli pendant près de trois siècles. On en vit reparaitre, à l'exposition de 1806, quelques produits qui furent présentés par M. Gafdeur. Ils étaient exécutés avec une pâte à laquelle on donne le nom de carton pierre: En 1819, M. Huseh recut une médaille de bronze pour de nouvelles applications de cette substance; mais jusque là tout ce borne encore à d'heureux essais. Il était réservé aux artistes dont nous allons parler de relever complètement cet art, et de lui donner même un nouvel éclat.

Ces artistes, qui se suivent de très près, malgré quelques légères différences dans la manière de préparer le carton-pierre, parviennent à mouler cette substance avec une telle perfection, qu'ils obtiennent de suite, et sans reparage, les contours les plus nets et les surfaces les plus unies.

De belles épreuves de statues rappelant toute la grâce, toute la pureté et tout l'esprit des originaux, des ornemens du meilleur goût, offrant tout le relief et tout l'effet pittoresque de la sculpture, des candelabras, des colonnes, des entablemens profilés avec une grande pureté, prouvent que le carton-pierre est susceptible, entre les mains des hommes habiles dont nous parlons, de reproduire fidèlement les inspirations du statuaire, et de se prêter, avec une facilité merveilleuse, à l'exécution des conceptions les plus délicates ou les plus grandioses de l'architecture, pour la décoration des intérieurs."

#### 4.—*Progress of Improvement in France.*

*Statistics.*—Since the peace, France has increased three millions; she has now about 33 millions of people, about 7,000,000 of families, and there are in this population four millions of small proprietors residing on their properties. France is improving rapidly. When the whole of the woodlands are converted into arable, and coal used instead of wood, France may easily carry a population of sixty millions of people.

The price of land carriage is about four pence per mile per ton; in America about two shillings and one penny; in Ireland about four or five pence. Iron sells in France for £18 per ton;—in London for £7—in Wales for £6—Raw Sugar is raised here from Beetroot at 8 sous per lb. and it is considered that it will be raised for 6 sous per lb. France has doubled her consumption of Iron yearly within these few years.

*Arts.*—The instrument-maker, M. Gambey, has invented a new level, which Mr. Arago praises extremely, and the great circle which he is now making for Brussels, is a model of execution. You would have been astonished at the fine divisions cut in the limbs of all his instruments, exceeding any thing of the kind to be seen in London. I have been to see the sawing machine, which gives twenty-five cuts of timber in one inch; and the snuff mill, which manufactures one ton of snuff in an hour; it is driven by a thirty-six horse-power engine. The composition with which they paint the names of the streets is volcanic and quite monumental, it would be valuable for Edinburgh and other places in our country. The beautiful ladies combs now so much in fashion are made of the prepared horn hoofs of oxen; this manufacture is, I believe, hitherto unknown in England. The French are succeeding with the Cashmir Goats, they have now about two hundred or upwards in excellent thriving condition.

#### 5.—*Mode of conducting the Meetings of the Académie.*

A very interesting letter was read before the Institute by Gay-Lussac. It was from Humboldt, and was addressed to Arago;—the letter related to Humboldt's late journey into Siberia. Last Monday, a most important paper was read before

the Institute by Brongniart, on Geology, in which some new doctrines were advanced, which were opposed by Cordier; the discussions on this subject became very animated.—Cuvier read a paper on the objects of Natural History, which had been collected by the naturalists who accompanied Captain Dumont d'Urville in his late voyage round the world.—M. Mathieu read a small paper regarding the invention of a new instrument for measuring distances on paper, and also for protracting distances correctly on maps: the instrument is extremely simple, and I think it will be of great use to the graphic art.—He also read a paper lately, describing an instrument for drawing parallel lines: I have not seen this instrument. The Institute is the most interesting place I ever frequented, there is always something new; all the members are educated, scientific men, eminently distinguished in their several departments, well qualified to judge of whatever may come before them; there is no dross or rubbish, the entire body is solid and pure.'

#### 6.—*Caoutchouc.*

[From the Journal of the Franklin Institute.]

We have received from the above-named gentleman some account of his experiments on the distension and inflation of *Caoutchouc*; he has also read a paper upon the subject before the American Philosophical Society, and several notices respecting them have likewise appeared in the daily journals. We may probably hereafter lay some further details before our readers. The communication referred to contains the following information:

#### MODE OF MAKING GUM ELASTIC INTO BAGS, SHEETS, &c.

Soak the gum elastic in sulphuric ether until soft, and almost melastic, which in good ether will take from 10 to 24 hours. Then, if it is a plate, cut it with a wet knife, or parallel knives, into such sections, or sheets, or shapes, as may be desired, and suffer them to dry; or if a bag, apply a pipe or stop-cock, and inflate with the mouth rapidly. If the bag should expand equally, more slowly; and with occasional pauses, if unequally. By such means a bag may be made so thin as to become transparent, and light enough to ascend when filled with hydrogen. By graduating the extent of inflation, sheet *caoutchouc* of any given thickness is produced. It for blow-pipes, or other purposes, for which it is desirable that the bags should possess contractility, let them be inflated to the desired size and after an hour let out the air. Ever afterwards they will suffer as great a degree of extension, and again contract. If permanent sheets are wanted, the inflated bags are to be hung up until dry, after which no sensible contraction will ensue.

*Caoutchouc* softened by ether may be readily stretched by hand, over lasts, assume the shape desired, and may, therefore, be applied to a variety of useful purposes. In the form of straps and twisted strings, its elasticity offers many useful applications. It may be made to assume the form of a tube, to connect parts of chemical and other philosophical apparatus with each other; may be employed as covers for bottles, corks, &c. and indeed wherever the passage of steam, or air is to be prevented. It is also susceptible of numerous applications in medicine and surgery.

Mr. Mitchill has extended a bag which was not above the size of a skinned English walnut, and which weighed three drachms and a half, until its diameters were 15 and 13½ inches respectively. Larger bags have been made to attain a diameter of six feet; one of these when filled with hydrogen, escaped, and was found at the distance of 130 miles from the city. Balloons so formed have been exhibited before the several classes attending chemical lectures in Philadelphia.

The discovery, by the same gentleman, that essential oil of sassafras will soften caoutchouc so that it may be applied to any surface with a brush, promises also much utility. When dry it becomes again simple caoutchouc, with all its original elasticity; if it be applied on a plate of glass, dried, and then immersed in cold water, the sheet may be peeled off. It has been spread upon paper, and after becoming dry, the whole immersed in water, when on stretching it, the paper would, of course, separate into fragments, between which the gum elastic might be stretched, so as to separate them to the distance of a quarter of an inch without itself giving way, notwithstanding its tenuity; such a varnish will never crack, one of its essential attributes being elasticity.

7.—*Directions for collecting and preserving Plants in foreign Countries.* By W. J.

Hooker, LL.D. Reg. Prof. Bot. at Glasgow.

ON PRESERVING PLANTS FOR A *HORTUS SICCUS*.

This is a much simpler process than is generally imagined by those unpractised in it; and many travellers have been deterred from collecting specimens by the time and trouble requisite for securing them in the way that has been generally recommended.

The main circumstances to be attended to are, to preserve specimens of plants in such a manner that the moisture may be quickly absorbed, the colours as much as possible preserved, and such a degree of pressure given to them, as that they may not curl up in the act of drying.

For this purpose, let a quantity of separate sheets of paper be obtained, of a folio size, and of an absorbent nature. Common cartridge or gray paper is perhaps the best. Brown paper does well enough for coarse plants, and blotting paper for the more delicate kinds. Two boards should be provided, one for the top and the other for the bottom of the mass of papers. For pressure at home, or when stationary for any length of time in a given spot, nothing serves better as a press than a weight of any kind, a large stone, a great book, &c. put upon the topmost board; and the great advantage in this is, that the weight follows the shrinking of the plants beneath. Whilst travelling, nothing is so convenient as three leathern straps with buckles—two to bind the boards transversely, and one longitudinally. It will be farther desirable to have a number of pieces of pasteboard, of the same size as the paper, to separate different portions of the collection, either such as are in a different state of dryness, or such as, by their hard or stout woody nature, might otherwise press upon more delicate ones that are in papers adjoining, and be the means of injuring them.

Thus provided, gather your specimens: if the plants be small, root and stem; if large, cut off portions of the branches of a foot or a foot and a half long, selecting always such as are in flower, and others in a more or less advanced state of fruit. Place them side by side, but never one upon another, on the same sheet, and lay upon them one, two, or three sheets, according to the thickness of your paper or of your plants, and so on, layer above layer of paper and specimens, subjecting them then to pressure. As soon as you find that the paper has absorbed a considerable portion of the moisture, (which will be according to the more or less succulent nature of the plants, and the heat and dryness of the season or climate,) remove the specimens into fresh papers; and let the old papers be dried for use again, either in the open air and sun, or in a heated room, or before the fire.

As to the spreading out of the leaves and flowers with small weights, penny pieces, &c. it is quite needless. The leaves and flowers are best displayed by nature in

VII.—*Proceedings of Societies.*

## I.—ASIATIC SOCIETY.

*Wednesday, 7th March, 1832.*

The Hon'ble Sir C. E. Grey, President, in the chair.

The President announced to the meeting the request of the Editor of the *Gleanings of Science* to continue that publication under the designation of the *Journal of the Asiatic Society*.

*Resolved*, that permission be granted, to be continued as long as the publication is under the charge of one or both the Secretaries of the Society.

Read a letter from Mr. Goodhull, presenting drawing of a fossil shell.

Read a letter from Captain Mitchell, forwarding to the Museum a Bush Copra in spirits.

Read a note from Baboo Radhacant Deb, presenting a young Pigeon with two heads, for the Museum.

The Meteorological Registers for November and December were presented by the Surveyor General.

Mr. F. Royle displayed to the Society a portion of the collections made by him while superintendent of the Sháhranpúr Botanic Garden, in the various branches of Natural History, and proceeded to illustrate the objects of his researches by a general review of the climate, the geology, the botany, and the zoological productions of the part of the country he had just quitted.

Such of his remarks as had not solely reference to the objects under inspection by the Society, have been selected for publication in the present number: Upon the termination of his interesting address the President rose, and moved the thanks of the Society in the following words.

"I am sure that I only express what is felt by the Society, when I say that we greatly regret we have nothing better to offer to Mr. Royle than a vote of thanks in return for the gratification and instruction he has afforded us, or whereby we can signify the opinion which we entertain of his meritorious services in the cause of science. Other collections of greater magnitude have gone home from India. In the department of botany we know how vast and precious a freight was borne across the sea by our zealous and indefatigable friend Dr. Wallich, and with how much admiration the display of it has been hailed in Europe. Other cabinets of great merit, and, perhaps, more complete than this of Mr. Royle's in single branches of Natural History, have been formed of late years; but I am not aware of any, certainly not of any which has been freely submitted to the examination of our Society, which has been of equal variety, curiosity, and interest with that which is now open before us. Here are new acquisitions in the zoology, ornithology, entomology, and geology of northern India and the Himalaya; and in the scientific observations by which we have heard them explained and illustrated this evening, we find an error of the learned and celebrated founder of our Society corrected; familiar and household words of the existing races of India and Persia identified with the terms of the *Materia Medica* of Dioscorides, and the first annunciation of important geological discoveries by a friend of Mr. Royle's in continuation of his own researches, which promise to bring the fossils of India, so recently supposed to possess none of those primæval records, into curious and interesting comparison with the vast stores of Europe and America.

"It is peculiarly gratifying to myself to have had the duty of offering our thanks on this occasion, upon account of my having before seen this museum in that glorious region, to which it owes its existence, and having been indebted to Mr. Royle both for his civility in permitting me to inspect it, and for the pleasure and surprize of finding in the Botanic Garden, at Seháranpúr, the English daisy, looking up from the plain of India to the lofty snows of the Himalaya."

*Resolved*, upon the motion of the President, seconded by Dr. Carey, that the Society, in tendering their thanks to Mr. Royle for the inspection of the extensive and interesting collections submitted by him to the Meeting, and the remarks illustrative of them, feel it incumbent to express their regret that any acknowledgments they can offer are an inadequate return for the gratification and instruction they have received.

And further that the Committee of Papers be requested to consider whether a letter may not be addressed to the Honorable the Court of Directors, introducing to their notice the labours of Mr. Royle; and if they deem it expedient, to prepare a letter accordingly for Mr. Royle to carry with him.

## 2.—MEDICAL AND PHYSICAL SOCIETY.

*3rd March, 1832.*

The following gentlemen, formerly proposed, were elected Members of the Society:—Messrs. Shirreff and Holmes, Assistant Surgeons, Bengal Service; Mr. Oxley, Assistant Surgeon, Sincapore; Mr. Richards, Surgeon, 8th Madras Light Cavalry, and Dr. J. N. Casanova. J. C. Boswell, Esq. Assistant Surgeon, at Penang, was proposed as a Member of the Society, by Mr. Hutchinson and Mr. Twining.

The following communications were then laid before the Society:

1.—A letter from Colonel Tod, presenting to the Medical Society, through Dr. Craigie, various objects of Natural History, from Van Diemen's Land. These consisted of some Lignites, two specimens of *Ornithorynchus Paradoxus*, and a variety of Birds. The thanks of the Society were voted to Colonel Tod, for his valuable present; and a Committee was requested to examine the several articles carefully, for the purpose of selecting such specimens as cannot be preserved in this country, and having them transmitted to England, while in a good state of preservation.

2.—Additional communications from Dr. Mylne, of Bombay, relative to *Dracunculus*, in confirmation of the opinions already advanced by him on that subject.

3.—A case of Disease of the Heart, drawn up by Mr. Spurgeon, and forwarded by Dr. Thomas, through the Medical Board.

4.—An Essay on Hospital Gangrene, by J. L. Geddes, Esq. of the Madras Medical service.

5.—Two cases, in each of which both the common Carotid Arteries were tied; by Mr. Preston of Cuddalore.

6.—An account of the Medical Topography of the Niclgherry Hills, and the influence of that climate on healthy and on impaired European constitutions, by Dr. Baikie.

7.—Remarks on *Dracunculus*, by Dr. Smytten, of Bombay.

8.—A Medical Report relative to the station of Gowhattie, in Assam; and an account of the diseases which have recently prevailed in that district, by G. Lamb, Esq. of Dacca, presented by the Medical Board.

9.—A report by J. C. Boswell, Esq. on an Opiate recently used at Penang. This medicine was made by digesting solution of tartaric acid in water on the drugs remaining after the tincture of opium has been prepared. Only a small quantity of this Penang Opiate was received, and it was tried by Mr. Twining, who reported that it appeared to possess considerable efficacy; its anodyne and soporific properties being estimated at about half the strength of Vinum Opii.

10.—Mr. Royle's paper, in pursuance of his proposal formerly laid before the Society, with a view of promoting the collection of a complete cabinet of specimens of the *Materia Medica* of Hindústan. The author considers his inquiries merely as preparatory to a complete investigation of the *Materia Medica* of India; which investigation he would wish to comprise, not only an inquiry as to the plants which produce each article; but would desire to see the real properties of the medicines ascertained by the most careful experiments, which, of course, can only be accomplished by the united labours of the Members of the Society, at some remote period: for the present, Mr. R. brought for inspection of the Society arranged specimens of nearly a thousand articles of *Materia Medica*, with an herbarium, containing the plants, from parts of which many of the articles are produced; and for the purpose of facilitating the labours of others, he stated the mode which he adopted to procure the specimens now laid before the Society. In the first place, he collected the various articles of *Materia Medica* procurable in the bazars, and then employed *Kubarees* to bring in the plants which produced the respective medicines; by this means he was enabled to ascertain the Botanical names of many of the plants indigenous at several stations.

In investigating the medicinal properties of the several articles, the author observes, that we may be somewhat guided by the sensible properties of the medicines: and no slight assistance may be obtained by reference to the natural families to which the plants belong—for instance, the *Convolvulacæ* afford the Jalap, the Scammony, the *Toorbud*, (*Convolvulus Turpethem*) and several Indian purgatives. The *Asclepiadæ* afford emetic medicine, as the *Ipecacuanha* of America, and *Asclepias Vomitoria*, and *Asclepias Asthmatica*. The *Coniferæ* in India, as in Europe, yield Turpentine. The *Euphorbiacæ* yield Euphorbium, and the *Jatropha Curcas* (Barbadoes Nut), and in India, the Castor Oil, and the *Croton Tiglium*; the latter affording an acrid oil of highly active properties. The *Labiata* in both countries possess aromatic and heating properties; while many of the *Solanæ* are poisonous. The *Gentianæ* being all bitter; the *Rubiaceæ*, mostly astringent, and the *Umbelliferæ*, aromatic. In fact, a very extended accordance may be observed in the sensible and medicinal properties of a large proportion of each of the natural families into which plants are divided. In preparing his MSS. the author states that he commenced by adopting the alphabetical arrangement of the Persian authors, inserting first the Asiatic names and synonyms: then the Greek names, followed by the Botanical name, the class, and order, according to the Linnæan system, and the natural order of the plant; after which he notices the country whence the article is said to be procured, the part of the plant which is used, and the medical properties ascribed to it by the *Hakims*, or stated in their books, with some general remarks tending to identify the article. Separate lists contain the medicines belonging to the mineral and animal kingdom.

The 100 specimens of *Materia Medica* promised formerly by Mr. Royle, are deposited in the cabinet: and Members of the Society, at the different stations, are invited to collect and contribute such articles as may be peculiar to that part

of the country where they are stationed. If each Member of the Society would carefully make a series of experiments to ascertain the medicinal properties of the drugs which he collected, when used by natives, as well as by Europeans, and forward to the Society a concise account of the same, much useful information would soon be obtained, which might be printed in an arranged series in the Society's Transactions.

Mr. J. C. Boswell's medical report and cases were then read, and discussed by the Meeting.

### 3.—NATURAL HISTORY SOCIETY OF THE MAURITIUS.

[Extracts from the Proceedings of the 17th May and 14th June, 1831.]

Mr. Lienard, Sen. read a description of two fishes of the island : one, of which a drawing was presented, known by the fishermen as the *Battoir*, not offering the distinctive characters of any of the known genera of the family of *Percoïdes*, to which it apparently belongs, has received provisionally the name of *Platésome*. The second, commonly called *Lion mûle*, is a *Holocentre*, but not the *Holocentre Samner* of CUV. and VAL. neither of these species are described in the tables.

Mr. J. Lienard presented an account of a crab of the genus *Portune*, accompanied by a drawing. Also a description and drawing of an *Acanthure* very rare in those seas.

Mr. Faraguet presented and explained his table representing geometrically the law of the temperature of the seas at different depths ; it is founded on the experiments made on board the *Astrolabe*, the only ones of the kind upon which confidence can be placed. It was found that at a depth of 820 brasses (fathoms) to which the lead attained, the temperature was 6.4 Cent. (43° Fahr.) and that the curve representing the results is a parabola of a high order, having for asymptote a vertical corresponding to a temperature of 4 or 5° centigrade, (40 Fahr.) At the depth of 1000 brasses (fathoms) a brass cylinder of 3 lines thick (containing the thermometer?) was broken, which is not surprising when the pressure is calculated.

Mr. J. R. Barry communicated a note on the subject of the temperature of mines of different depths. By observations made in Cornwall, in 1815, it was ascertained that at 1400 ft. Eng. below the surface, the temperature of mines exceeds that of the surface of the globe 28° Fahr. and that the heat augments progressively in descending at the rate of 1° for 65 feet.

Mr. J. Desjardins, Sec. read some pages relative to certain races inhabiting the Mauritius and Bourbon.

Also, conjointly with Mr. L. Bouton, Mr. J. D. read a notice of the Naturalist Commerson, well known as the principal contributor to the knowledge of the natural history of the island. Mr. J. D. treated of his zoological labours, while Mr. L. B. gave details of his life and works in general.

Commerson came to the island in 1768, and remained with M. de Bougainville to study its productions. He enjoyed greater means of research than any since his time. After a voyage to Bourbon and Madagascar, he returned to Mauritius, where he died on the 3rd March, 1773, at a place known by the name of *la Retraite*.

Mr. Ch. Telfair, president, presented 40 birds from Tasmania.

Mr. Lislet-Geoffroy offered for the library, the analyses of the Royal Academy's Proceedings from 1812 to 1829.

Mr. E. Baker, who had sent several manuscripts from Madagascar, on different subjects, was admitted a corresponding member of the Society.



*Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of March, 1832.*

| Meteorological Register kept at the Surveyor General's Office, Canterbury, Province of Canterbury. |                             |                     |                      |       |                    |                     |                     |                      |       |                    |                     |                     |                      | Sunset.                               |                    |                                     |                     |  |       |                                      |                    |                              |  |
|--|-----------------------------|---------------------|----------------------|-------|--------------------|---------------------|---------------------|----------------------|-------|--------------------|---------------------|---------------------|----------------------|---------------------------------------|--------------------|-------------------------------------|---------------------|--|-------|--------------------------------------|--------------------|------------------------------|--|
| Minimum Temperature observed at Sun-the.   |                             |                     |                      |       |                    |                     |                     |                      |       |                    |                     |                     |                      | Maximum Pressure observed at 9h. 50m. |                    | Observations made at apparent Noon. |                     | Max. Temp. and Dryness observed at 4th. 40m. |       | Minimum Pressure observed at 4h. 0m. |                    | Observations made at Sunset. |  |
| Days of the Month.   | Baromet-ter reduced to 32°. | Temper. of the air. | Depres. of M.B.Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°. | Temper. of the air. | Depres. of M.B.Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°. | Temper. of the air. | Depres. of M.B.Ther. | Wind.                                 | Aspect of the sky. | Barom. red. to 32°.                 | Temper. of the air. | Depres. of M.B.Ther.                         | Wind. | Aspect of the sky.                   | Rain Gauge, No. 1. | Rain Gauge, No. 2.           |  |
| 1  | 29.802                      | 56.5                | 2.3                  | cm.   | cl.                | 29.854              | 73.                 | 15.3                 | u.w.  | cl.                | 29.818              | 76.3                | 15.3                 | u.w.                                  | cl.                | 29.833                              | 80.                 | 12.3   | u.w.  | cl.                                  |                    |                              |  |
| 2  | 29.800                      | 56.5                | 2.3                  | cm.   | cl.                | 29.854              | 73.                 | 15.3                 | u.w.  | cl.                | 29.818              | 76.3                | 15.3                 | u.w.                                  | cl.                | 29.833                              | 80.                 | 12.3   | u.w.  | cl.                                  |                    |                              |  |
| 3  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 4  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 5  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 6  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 7  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 8  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 9  | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 10   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 11   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 12   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 13   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 14   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 15   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 16   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 17   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 18   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 19   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 20   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 21   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 22   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 23   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 24   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 25   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 26   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 27   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 28   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 29   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 30   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| 31   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |
| Mean   | 29.802                      | 56.5                | 2.6                  | cm.   | do.                | 29.811              | 76.3                | 13.1                 | w.    | do.                | 29.822              | 82.5                | 14.5                 | w.                                    | do.                | 29.842                              | 75.5                | 22.5   | w.    | do.                                  |                    |                              |  |

Abbreviations. In the column "wind," small letters have been used instead of capitals; *cu.* means *calm*. In the column "aspect of the sky," *cg.* is *cloudy*. *cl.* clear; *rn.* rain; *ci.* cirrus; *cs.* cumulus; *cc.* cirro-stratus; *cc.* cirro-cumulus; *n.* nimbus.

Mean 29.800 56.5 2.3 0.60 0.48 1.15 1.00 1.32 1.25





IRON SMELTING FURNACE  
of the  
KAIYA HILLS

# JOURNAL

OF

## THE ASIATIC SOCIETY.

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No. 4.—April, 1832.

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I.—*Geographical Notice of Tibet.* By Mr. Alexander Csoma de Körös.

The vast mountainous tract of country between about 73° and 98° east longitude from London, and 27° and 38° north latitude, may be called by the general name of "Tibet," since the Tibetan language is understood every where from Beltistan (or Little Tibet) down to the frontier of China, although there be several corrupt dialects of it, and the inhabitants of these countries, in general, have the same manners and customs, are addicted to the same faith, (to Buddhism,) and have the same religious books written or printed in characters common to all the different provinces.

The native name of Tibet is "*Pot*," as it is pronounced commonly; "*Bod*," more properly. It denotes both the nation, and the country: for distinction's sake the country is expressed by "*Bod-yul*" (Bod-land), a male native "*Bod-pa*," and a female one "*Bod-mo*." The Indian name for Tibet is *Bhot*.

The natives of Tibet apply the name *Pot*, or *Bod*, especially to the middle Tibet, or to the two provinces "*U*" and "*Tsang*" (*Dvus-Qtsang*, pronounced *U-tsang*), the capitals of which are *Lhasa* and *Shikátse*. Hence a native of those two provinces is called by them especially *Pot-pa*. The eastern part of Tibet is called "*K'ham*" or "*K'ham-yul*," also "Great Tibet." The north-western part towards Ladak is called "*Nári*." Bhutan is called by several names by the Tibetans; as, "*Lhopato*," "*Lho-mon-k'ha-zhi*," "*Lhobruk-pé-yul*," or simply "*Lho*," (the south.) According to these divisions, the inhabitants of Tibet are distinguished thus: "*Pot-pa*"

(or *U-tsung-pa*), means a native of middle Tibet; "*K'ham-pa*" (or *K'ham-ba*), one of eastern Tibet; "*Nári-pa*," one of western Tibet; and "*Lho-pa*," a native of Bhutan.

The whole of Tibet occupies high ground, and lies among snowy mountains. Hence it is called in Tibetan books, by several poetical names, expressive of snow, ice, or frozen snow, cold, and high elevation. The highest ground in Tibet is in *Nári*, especially the peak called *Tísé* or *Tésé*, in Tibetan, and *Kailasa* in Sanscrit, about 80° E. longitude, and 34° North latitude. The sources of the Indus, Setledge, Gogra, and the Brahmaputra rivers are in *Nári* (*Mñahris*). There are several large lakes also. Tibetan writers, in describing the situation of Tibet, have likened *Nári* to a lake or watering pond; *U-tsang* to four channels; and *K'ham-yul* to a field.

Tibet is bounded on the north by the countries of the Turks and Mongols, whom the Tibetans call *Ilor*, and *Sok-po* (*Hor-sok*). On the east by China, (*Gyanak* in Tib.) On the south by India, (*Gyagar* in Tib.) On the west by India, Cashmir, Afganistan, *Tazik-yul*, and Turkistan.

The hill people of India, who dwell next to the Tibetans, are called by them by the general name "*Mon*," their country *Mon-yul*, a man *Mon-pa* or simply *Mon*, a female *Mon-mo*.

From the first range of the Himalaya mountains on the Indian side to the plains of Tartary, the Tibetans count six chains of mountains running in a north-western and south-eastern direction, when viewed from Kangri in *Nári* (a lofty mountain running from south-west to north-west), whence the ground commences to take on one side a north-western and on the other side a south-eastern inclination. In the spacious valley, which is between the third and fourth range of the before mentioned mountains, is the great road of communication between *Ladak* and *U-tsang*. The principal countries or districts in this direction, from north-west, are as follows: *Beltistan* or Little Tibet, *Ladak*, *Teshigang*, *Gár* or *Gáro* (the lower and upper), *Troshot*, *Tsáng*, *U*, *Bhrigang*. It is here likewise, that the two principal rivers, the *Sengé k'há-bab*, and the *Tsúm-po* take their course; that by *Ladak* to the north-west, and may be taken for the principal branch of the Indus; this to the south-east, and forms afterwards the Brahmaputra.

The countries on the Indian side that lie next to Tibet, commencing from Cashmir, are as follows: "*K'ha-ch'hé-yul*" (or *K'ha-ch'hul*), Cashmir; *Varan*, *Mandé*, *Palder* or *Chatirgerh*, *Pángé*, *Gár-zha* or *Lahul*, *Nyungti* or *Kullu*; *K'hunu* or *Knaor*, and *Bésahr*; *Kyonam*

and *Shák'hok*, or Garhwal and Kamaon; *Dsumlung*; *Gorkha-yul*; *Pal-yul* (*Bal-yul*) or Népal; *Lhopato* or Bhutan; *Ashong* or Asam.

The names of the countries or districts in Tibet that lie next to India, commencing from Cashmir, are as follows: *Himbab* (near to Cashmir), *Purík*, *Zanskar*, *Spiti*, *Gugé*, *Purang*, *Kystrong*, *Lhoprák*, *Myánam*, *Lach'hi*, *Mon-ts'ho-sua*.

Beyond the fourth range of the Himalaya mountains, or in the next valley to the north of Ladak, there are the following districts, counting them eastward: *Nubra*, *Rudok*, *Tso-tso*, *Bombá*, *Chang-ts'ha-k'há*, *Chang-ra greng*.

The three great divisions of Tibet are:

1. Tibet Proper, or *U-tsáng*. 2. *K'ham-yul*, or the eastern part of Tibet, and 3. *Nári*, or the north-western part of Tibet.

I. Tibet Proper or *U-tsáng*. It is that part of Tibet which lies next to the north of Asam, Bhutan, and Nepal, that is called by this name. This is the most considerable part of Tibet. The inhabitants of this division are the most industrious, skilful, and polite of all the Tibetan races. The number of the inhabitants in these two provinces is said to be about one hundred and thirty thousand families. *Lhassa* is the capital of the province *U*, as also of the whole of Tibet. From the seventh till the tenth century it has been the residence of the kings of Tibet. Now it is the first place for commerce in Tibet, the seat of government, and the residence of the Chinese *Ambans* (or ministers). There are several religious establishments. Near *Lhassa* is *Potala*, the residence of the great Lámá, (styled *Gyel-rá-rin-po-ch'hé*), the head of the sect called *Géluk-pa* or *Geldampa*. Other remarkable places, in the province *U*, are: *Yam-bu-Lhá-gáng*, a fort or castle built in the fourth century, by *Thothori*, a king. It has been the residence of the ancient kings. It contains some antiquities, and plastic images of the ancient kings. It is a few days' journey to the south from *Lhassa*. *Sam-yé* (*Bsam-yas*) a royal residence and a large monastery, one day's journey from *Lhassa*, built in the eighth century by *K'hri-srong-déhu-tsan*, a celebrated king. There are deposited several ancient books taken from India. In the province of *U*, among other forts or castles, *Dé-ch'hén-song* and *Haspori* are the most considerable. In the province of *Tsang*, the following ones are of some repute: *Chang-nam-ring*, *Chang-Lha-tsé*, *Phun-ts'hok-ling*, and *Gyang-tsé*.

2. *K'ham-yul* (*K'hams-yul*), called also *Pot-ch'hen*, or Great Tibet, consists of the eastern part of Tibet, and is bounded

by China on the east. There are several small principalities; as, *K'ham-bo*, *Gábá*, *Li-thang*, *Dé-gé* (or *Der-gké*), *Brag-yak*, *Dép-ma*, *Go-jo*, *Gya-mo-rong*, *Jang-sa-tam*, *Amdo*, *K'hyamdo*, &c. The people of these parts differ very much from the rest of the Tibetans in their stature, features, dress, customs, and in the manner of speaking the Tibetan language. They are very robust, passionate, void of artifice or cunning, not fond of ornaments on their dress. In *K'ham-yul*, those called *Pon* or *Bon*, holding still the ancient religion of Tibet, are very numerous. They have also their literature, religious order, several monasteries, and kill several animals, great and small cattle, for sacrifice: they have many superstitious rites.

3. The north-western part of Tibet, from *Tsang* to *Ladak*, is called *Nári*. This part is of very great extent, but the number of inhabitants is inconsiderable, not exceeding fifty thousand families together with *Ladak* and *Beltistan*. There have been several small principalities formerly in *Nári*, as, *Gugé*, *Purúng*, *Kangri*; but all these belong now to the great *Lámá* at *Lhassa*, and are governed by *K'harpons* (commanders of forts) sent from *Lhassa*. There are also in *Nári* very extensive deserts. The inhabitants dwell in tents, made of hair cloth; exercise a pastoral life, without any agriculture. Their number is said to amount to ten thousand families, and they all are under the *sGar-pon* or chief officer residing at *sGúr* or *sGáro*, who is sent from *U-tsang* or *Lhassa*, and generally remains there for three years.

*Gugé*, part of *Nári*, lying to the north of *Garhwal* and *Kamáon*, consists of two valleys, inhabited by somewhat more than two thousand families. The principal places are *Tsaprang* and *Tholing*, not far from each other. The first is the residence of the commanding officer called the *Kh'arpon* of *Tsaprang*, and the second is a large monastery and the seat of a *Lámá* styled the *K'hanpo* of *Tholing*. He resides during the summer at *Teshigang*, another large monastery, a few days' journey to the north from *Tholing*. These two places, (*Tsaprang* and *Tholing*) have been the residence of the princes that have reigned there from the 10th till the end of the 17th century.

*Ladak*, formerly called *Mar-yul*, still has its own prince, but he must accommodate himself to the political views of the Chinese. *Zan-skqr*, *Purik*, *Nubra*, form part of the *Ladak* principality. In the whole of *Ladak* the number of the inhabitants does not exceed twenty thousand families. Nearly the half of them are Mohammedans, mostly of the Shia persuasion. *Lé* (*slé*) is the capital of *Ladak*, the residence of the prince, and the emporium of a considerable trade with *Turkistan*, *Lhassa*, and the *Panjab* countries. It is about 15 to 20

days' journey from Cashmír to the east, and nearly under the same latitude, (i. e.  $34^{\circ}$  north lat.)

Little Tibet or Beltistan (*Belti-yul*, in Tibetan), is the most north-western part of Tibet. There are several chiefs. The chief residing at *Kárdo* is the most powerful among them; those of *Kyeré* and *Kuru*, with some others, depend on the former. The chief of *Shig'ir* holds sometimes with the prince of Ladak and sometimes with the chief of *Kárdo*. The chiefs of *Minaro*, *Hasora*, &c. are the heads of some predatory tribes. In the several defiles to the south, in the neighbourhood of Beltistan, there live some predatory tribes, among whom the most notorious are the *Dirdu* people. These barbarous tribes are either of Afghán or Hindú origin. The inhabitants of Beltistan are Mahomedans of the Shia persuasion. They speak a dialect of the Tibetan language, but have nothing of the Tibetan literature. They keep some books or fragments in Persian. The correspondence from Ladak with the chiefs of those parts, is carried on in Persian, as also with Cashmír. The people of Beltistan are very unhappy on account of their chiefs having continual quarrels with each other, or with the prince of Ladak. The climate is warm. In the lower part of Beltistan, snow never falls. The soil is good. There are several kinds of grain; they have two crops. There are likewise several sorts of excellent fruits; as, of apples, pears, peaches, plums, figs, grapes, mulberries, &c. &c. There is a great want of salt and wool in those parts; formerly there existed a commercial route from Cashmír to Yarkand through Beltistan, (of 30 days journey;) but that country being in an unsettled state, the Cashmírian merchants afterwards preferred that through *Lé*, in Ladak, although it is very circuitous.

The people of *Lhopátó* or Bhutan, on account of their language, religion, and political connexion, belong to Tibet. But in their customs and manners they have adopted much from the Indians. They are more clean in their dresses and houses than the other Tibetan races. The men are of a martial spirit, like those of *K'ham-yul*, with whom they are said to have much resemblance in their character. The people of Bhutan speak a corrupt dialect of the Tibetan language; but there are several religious establishments, a great many books, and some religious persons are well acquainted with the Tibetan language and literature. They are Buddhists of the sect called in Tibet *Brakpa* (vulg. *Dukpa*.) They adopted this kind of Buddhism in the 17th century of our æra, when *Nák-Váng Nam-gyel*, a Lámá of great respectability, leaving *Tsúng* in middle Tibet, established himself in



**Bhutan.** There are counted now about forty thousand families. The whole province of Bhutan consists of four districts or valleys, which if counted from east to west, are as follows: *Thet-yul*, *Thim-yul*, *Patro* or *Pato*, and the middle district. The principal place is *Teshi-ch'hos-dsong*. •

**LAKES.**—There are four principal lakes in Tibet. The *Ma-pham yu-ts'ho* (Mansarovara), in *Nári*, is the most considerable, of a circumference of about one and a half day's journey. In *U-tsang*, the *Yarbrokyu-ts'ho*, *Mu-le-sgrum ts'ho*, and *Nam-ts'ho ch'hukmo* are likewise of great extent. There are many others of inferior rank or less compass; as, that of *Lá-nág* to the west of *Ma-pham*. From *Rádok* (near Ladak) to the east or south-east, there are many salt lakes.

**MEDICINAL OR MINERAL WATERS.**—Between *U* and *Ts'ang* there are some hot springs, used in curing cutaneous diseases and the gout. But such hot springs are numerous in the mountains lying east from the *Ma-pham* lake; especially at one place there is a hole out of which continually issues vapor, and at certain intervals, hot water is ejected with great noise to the height of 12 feet.

**GLACIERS.**—The summits of many of the Tibetan mountains remain through the whole year covered with snow. But there are especially four glaciers or mountains covered with ice or frozen snow; as, *Tisé*, *Havo*, *Shámpo*, and *Pulé*.

**MINES.**—Mines are rarely excavated in Tibet. In the northern part of *Nári*, and in *Gugé*, some gold dust is gathered, as also in *Zanskar* and *Beltistan* it is washed from the river. If they knew how to work mines, they might find in many places gold, copper, iron, and lead.

Petrifactions are found at many places in Tibet, especially in *Nári*. On the 2nd and 3rd range of the Himalaya mountains, there are several sorts of them. *Sálgráms* and shells are found most frequently, in many places. All such petrifactions are denominated in Tibetan, according to the resemblance they have to anything; as, sheep-eye, sheep-horn, sheep-brain, swine-head, bird-leg, cow-tongue, stone-trumpet, &c. They are not objects of reverence in Tibet, neither of curiosity. Some of them, after being burnt and reduced to powder, are used as medicaments in certain diseases.

In the whole of Tibet, there is, in general, a deficiency of wood, both for fuel and for building, or timber, especially in *Nári* and *U-tsang*. In *Bhutan* and *Beltistan* there are many sorts of fruit trees. In *K'ham-yul* there are some woods and forests. In the western part of *Ladak*, and in *Beltistan* some vines are cultivated. In middle

Tibet and Ladak the mountains are in general naked, destitute of herb, grass, and every vegetable. In the valleys, where the fields can be watered or irrigated, several kinds of corn are produced, especially wheat, barley, buck-wheat, millet, pease, and some others. In *Nári* and in the northern deserts of Tibet, there grow several kinds of medicinal herbs and plants, and there are likewise good pastures; but there are in the deserts no fields for producing corn, and what they want they purchase from those who inhabit the southern parts of *Nári*, and give them in exchange yaks, sheep, wool, woollen cloth, salt, borax, &c.

Rice is no where cultivated in Tibet. There are some kinds of pulse; as pease, bean, and lentils. There is no great variety of esculent plants. They have some turnips, cabbages, carrots, onions, garlicks, and a few others; but for potherbs they use in general such greens as grow wild. In the western part of Ladak, in Purik, there is a certain plant, (with bushy stalks) called *Prángos*, which is a good remedy against the rot in sheep, if given for food for a certain time, in autumn.

The daily food of the Tibetans consists, in general, of gruel, or thick pottage prepared from the meal of parched barley (*sutu*), several kinds of flesh, bread, sour-milk, curds, potherbs, and of tea prepared in a particular manner in a churn, with butter, salt, and with some milk, or without this last ingredient.

The origin of the Tibetans is referred in their fabulous history to the union of an ape with a she demon. Some derive them from India; some from China; others from the Mongols, and others from the Turks. Nothing can be certainly said in this respect. They have an original language, which has little affinity to that of any of the nations mentioned. It is probable, that the royal family who reigned in middle Tibet from about 250 years before Jesus Christ till the 10th century, was derived from India, from the *Lichabyi* race, and it is certain that their religion and literature is of Indian origin. The Tibetans are ignorant of their origin. They distinguish now five sorts of people or races (or nations) among themselves; as 1. *K'ham-ba*, one dwelling in *K'ham-yul*. 2. *Pot-pa*, one inhabiting *U-tsang*. 3. *Brok-pa* or *Hor-pa*, one living in the deserts to the north-west of *Lhassa*. 4. *Nári-pa*, one of *Nári*, *Ladak* and *Beltistan*, and 5. *Lho-pa*, one of *Bhutan*. All of whom have yet other subdivisions. They differ much from each other in their stature, character, dress, and in the accent with which they pronounce the Tibetan language. But they can all understand each other. They all agree (with the exception of the Mahommedans in *Ladak* and *Beltistan*) in having the same religion, whose records are in the same language and character.

II.—*Account of Barren Island, in the Bay of Bengal, drawn up by the late Dr. J. Adam.*

(Read at a meeting of the Asiatic Society.)

Barren Island, with its volcano, from which the accompanying specimens were obtained\*, has been described in the 4th vol. of the RESEARCHES by Lieutenant (now Colonel) Colebrooke. That gentleman, however, did not visit it himself, but was indebted for his description to Captain Blair, who appears to have surveyed the whole cluster of the Andamans. The account is altogether very short, and any further particulars regarding the island, I have conceived, may not prove uninteresting. In this hope, I now beg leave to lay before the Society the following narrative, communicated to me by the same gentleman who has contributed the specimens. I shall give it in his own words, and I trust need make no apology for so doing.

“In the month of March last, in the passage from Carnicobar to Rangoon, I had occasion to approach close to Barren Island. It was first visible at daylight, and at 7 A. M. being within 10 or 12 miles of it, I could plainly perceive with my glass, volumes of white smoke issuing from the crater of the volcano. About 9 o'clock, we were very close to it, and being attracted by the singular appearance presented to us, and the wind at the time being adverse, I determined on visiting the island. Accompanied by my chief officer, I pulled for a small bay where, it was supposed, we should have no difficulty in landing. On approaching however to within a hundred yards of the shore, we were suddenly assailed by hot puffs of wind, and on dipping our fingers into the water, were surprized to find it as hot almost as if it had been boiling. The stones on shore, and the rocks exposed by the ebbing of the tide, were smoking and hissing, and the water was bubbling all round them. At this place we had a complete view of the cone, which did not then appear a quarter of a mile distant. Being unable to effect our object here, we pulled a little to the southward, and landed in a cove. We now commencéd ascending an almost perpendicular precipice, holding on by the loose grass that grew out of the ashes covering the rocks. With no small danger and difficulty we reached the top of the cliff, and had before us a smooth surface of ashes, extending to what we supposed to be the summit of the island. There being nothing to hold by, and the acclivity very abrupt, we all joined hands, and in this way, at length, succeeded in gaining the top of a ridge. Here

\* These specimens are, or ought to be, in the cabinet of the Asiatic Society.

we found a small tree, or rather large shrub, and being much fatigued with our previous exertions we sat down under its shade, and enjoyed from thence a fine view of the volcano. It is an immense cone, regularly sloping from the base to the summit, and in appearance and color (to compare great things with small) resembling a heap of sifted coal ashes, with cinders scattered over its surface. I cannot say exactly what the diameter of the base may be, but should suppose it not less than 800 or 1000 yards; at the top it may be about 30, and the whole of this space seems occupied by the mouth. Even at this height I could observe no flame, but large volumes of thin white smoke kept continually issuing from it. This cone stands by itself in the centre of an amphitheatre of hills, which nearly close around it; the only opening to the sea being where we attempted to land. The summits of the hills to the N. E. are completely smooth, and covered with ashes; those to the S. W. although partly covered with ashes also, have a good many small shrubs scattered over them, with dry parched grass growing on the surface. This appearance countenances a belief, that it is only in the south-west monsoon, or rainy season, that eruptions take place, at which time the S. W. wind would blow the dust and ashes on the hills in the opposite direction, or N. E.

“ Having dispatched a lascar from the spot where we sat down, to ascertain if it was yet far from the summit of the Island, he returned and stated, that we had apparently advanced a very little way compared with what still lay before us; and that we could not accomplish our object and be back before dusk. We therefore thought of descending, and as it would have been dangerous to do so the same way we came up, we were obliged to go by the other side of the ridge, where we had some grass, and occasionally a shrub or two to hold by.

“ We now rowed to where we first endeavoured to land, and found that the tide had flowed several feet, which enabled us to have the boat close in, and step on shore on the rocks. Being desirous to examine the crater, we had to walk about three quarters of a mile over immense fragments of the specimen No. 1, which extended from near the sea side to within a short distance of the volcano, and along the only valley or outlet that the island presented. From whence this rock was derived, I could not decidedly say. It was lying carelessly and so loosely as hardly to afford a sure footing in walking over it. It is indeed difficult to describe the form in which this was lying, for were you to take any quantity of large and small pieces of No. 1. and throw them down in the most random manner, you could not make them assume the strange disordered appearance that nature

here presents. I should not suppose that these masses were thrown from the volcano; as in that case, it appeared to me they would have been agglutinated together when in a state of fusion from intense heat, and also fixed to the surface. The impression on my mind at the time was, that some faint convulsion of the earth had elevated them directly from below. Along this dark tract there was no ashes, nor any thing indeed but the rock itself. On reaching the base of the cone, I casually picked up the specimen No. 2. Here viewing it, I judged the elevation to be half a mile to the top; but in my estimation of distances I do not pretend to be even near the truth. It sloped so suddenly from about halfway up to the top of the cone, that I considered it next to impossible to climb to the mouth. We ascended however 30 or 40 yards, sinking ankle-deep in ashes, at each slip, and I here took up the specimens Nos. 3 and 4, and the other two smaller pieces. I did not bring away any specimen of the ashes, but the color exactly resembles that of No. 3. In the whole of our ramble, we did not meet with a spot capable of yielding any vegetation, with exception of the withered grass formerly alluded to: nor, although we looked anxiously for fresh water among the rocks, could we perceive the smallest signs of it. The geographical site of the Island as given by Horsburgh seems perfectly correct; at least it agreed with my observations. The shore is extremely steep, and a ship may almost rub her side against the rock. Close in shore we could observe either tides or currents setting on eddies round some of the points; and in pulling from where we first endeavoured to land, to where we did land, we were in ripples."

On examining the specimen No. 1, it is evident that it must have undergone the action of fire; and notwithstanding the above opinion to the contrary, it has in all probability been ejected from the crater of the volcano. On this point indeed we have positive evidence, as Captain Blair, in Col. Colebrooke's description, declares he saw these masses thrown out from the volcano in a state of ignition, "many of which rolled down the cone, while they were close to it, and bounded a considerable way beyond them." The black scoria seems to derive its color from an impregnating iron; it contains minute crystals and grains of felspar. The specimen No. 2, resembles the former, but has been thrown from the volcano at an earlier period, and exhibits the contained crystals in a state of decomposition. No. 3 is a very compact lava, containing embedded in its substance distinctly crystallized basaltic hornblende. No. 4, though vesicular, is more compact than the two first varieties. Besides the felspar, it contains some dark-colored crystals, the nature of which I have not fully ascertained.

I may add, that the conjecture, respecting the volcano's being in activity only during the S. W. monsoon, derived from the appearance of the hills, is supported by analogy in similar cases, as it has been frequently observed that volcanic eruptions are influenced by the state of the atmosphere. In a late number of the *Edinburgh Philosophical Journal*, I met with a notice on this subject, which I shall here take the liberty of transcribing. Under the head of "Detonations in Mount Brazier," it is stated, that M. Dubois Ayne examined in 1818, the structure of the mountain situated between Senes and Leerogne in the Alps, which is known to emit flame, and produce detonations, which are most frequent when the wind is in one direction. He found that there were beds of pyritous chalk, marly schistus, radiated sulphuret of iron, and bituminous substances, &c. in the strata of limestone that formed its sides, and he supposes that the flames and detonations are produced by the accidental inflammation of hydrogen liberated by the action of water on the above substances." As rain generally accompanies the S. W. monsoon in the Bay of Bengal, may we not reasonably infer, that the activity of the volcano on Barren Island at that season also depends on the presence of water and its consequent conversion into its gaseous elements ?

III.—*Flora Indica, or Descriptions of Indian Plants.* By the late William Roxburgh, M. D. F. R. S. E. &c. &c. Vols. I. II. and III. Printed at Serampore, 1832.

[To be completed in four volumes.]

The appearance of the above work may well be considered as a subject of congratulation, not only as a lasting tribute of justice to the memory of one of our most distinguished men of science, but also as affording our countrymen, in this country, the means of prosecuting a very pleasing branch of their studies in Natural History.

The length of time that the present work has remained in manuscript, within the precincts of this metropolis, would argue either an apathy on the subject, or that the work itself had not been considered of sufficient value to risk the expences of publication. But that this cannot have been the reason is evident from the fact, that the two first volumes, which were published twelve and nine years since, had so extensive a sale as to have been long out of print, while inquiries too respecting it have continued as numerous as ever ; and there is no doubt that, had this work been published many years ago, it would have had not only an extensive circulation, but it would have been the means of producing a considerable number of zealous botanists, who would have

investigated what was described, and described what they found to be new : for at present, though there are numbers well inclined to prosecute the study of Indian Botany, of whom many are placed in the most favourable situations for obtaining a name, at the same time that they might contribute to the progress of the science ; yet that the number of actual cultivators have been so few, can only be ascribed to the difficulty which each has had in prosecuting a subject on which no books were procurable ; and without these, we are apt to fancy that we can do nothing, or suppose that we can find nothing which has not been already discovered. That nothing can be more erroneous is evident from the fact, that even in well-explored countries, such as England, Scotland, and France, many new plants have been found even in the most recent times.

The appearance of this work is to be considered an important circumstance, not only for the information itself communicated, but also from its being in an English dress ; for the neophytes of science will be more readily induced to enter a mansion of which the threshold is made accessible. Nothing so much promotes the spreading of a science as the publication of works of a popular nature and compendious form, and the present will be the forerunner of many such. That some attempts of this kind have not hitherto been made, can only be accounted for, by the supposition, that those who have laboured to acquire a knowledge of the science, surrounded as it is with great difficulties, have rather employed themselves in exploring new fields, than in endeavouring to assist others up the toilsome ascent, which they had by dint of much labour themselves ascended.

That materials have not been wanting for giving a short though imperfect view of Indian Botany, may be inferred from a view of the numerous species and genera of Indian Plants which are enumerated in the System of Willdenow and the Synopsis of Persoon. If the Indian species in these works had been extracted and published in a separate work in English, something might have been done towards inducing a greater taste for Indian Botany. But in justice, the want of such works must, in a great measure, be ascribed to the want of encouragement, and the apathy with which all endeavours to prosecute any of the branches of natural, or any other science, are viewed in India, and most other English colonies ; where what is pleased to be styled *practical* knowledge, is alone valued, and the inutility of scientific acquirement dilated on with a degree of complacency which is amusing, as chiefly indulged in by those who are totally unacquainted with the nature and objects of the species of knowledge they affect to despise, and the ultimate tendency of which they would perhaps be the more surprised to find was to produce the most certain practical results.

That materials have not been wanting we repeat, is evident, if we call to mind the authors who have expressly written on Indian Botany ; and among these, it is lamentable to find, that until the time of the author of the present work, none of our countrymen had distinguished themselves in the field.

As not having written expressly on the subject, it is perhaps needless to mention the names of Theophrastus, Dioscorides, and Pliny, though in their works many plants are mentioned as being natives of India, and these form very interesting subjects of research in the present day, besides Galen, Oribasius, Paulus Ægineta, and among the Arabians, Mesue, Serapion, Rhazes, Avicenna. By the latter authors many plants are mentioned, as being the produce of India, of which no attempt appears hitherto to have been made towards their identification. Ibn-ul-Bakhtar is said to have traversed Africa, Arabia, and India, for the prosecution of his favourite study of plants : his MSS. in the Escorial, contain descriptions of several thousand species ; and his work, which is frequently referred to by the Persian authors on Materia Medica, was much consulted in the composition of the *Geographia Sacra* of the learned Bochart.

The earliest Europeans who seem to have paid any attention to the useful plants of India, are the Portuguese physicians at Goa, Garcia *ab Horto* and Christopher da Costa, whose observations, with those of Belon, form the basis of the work of Ausius entitled *Exoticorum libri decem*. Antwerp, 1563. In the works of Prosper Alpinus, though on the plants and medicine of the Egyptians, many plants are mentioned of which the products are brought from India.

The first work, however, of any note on the plants of India is that of Rheede, entitled *Hortus Malabaricus*, in 12 volumes, folio, containing 794 plates, which, considering the time they were published, are highly creditable productions. Rheede resided chiefly on the Malabar coast, and was Governor of the Dutch settlements in the East Indies ; he procured all the new and curious plants in his power, described them, and had drawings made ; the plates have in them the native names, with the Arabic and Hindi characters. Plukenet collected nearly 8000 plants, and his works give plates of nearly 3000 species, among which are several Indian plants.

Kämpfer travelled in Persia, Arabia, and India on the Coromandel coast and along the banks of the Ganges, Java, Japan, &c. and his work *Amoenitates Exoticæ* contains accounts of many, and plates of some, plants of Japan, of which nearly allied species are found in the Himalayas. The sixth number of his work, which contained 600 figures of scarce plants growing along the Ganges, has been entirely lost.



Burmah, in his *Thesaurus Zeylanicus*, 1737, has given descriptions and figures of many Asiatic and some Indian plants.

Rumph came as physician to the East Indies, and became Chief Magistrate and President of the Mercantile Association of Amboyna; he collected carefully all the productions of India, especially plants. These are described and figured in his work, *Herbarium Amboinense*, 1750—1755, in six volumes, folio, with a supplementary or 7th volume bound up with the 6th. The descriptions are in Latin and Dutch, in separate columns, and the figures are extremely good.

N. J. Burmann, son of John Burmann, was Professor of Botany at Amsterdam. In his *Flora Indica*, 1768, he has represented in 67 plates, 176 very scarce plants, which had been collected by his father.

Rottler, Professor of Botany, at Copenhagen, has given excellent figures and descriptions of many of the Indian *Cyperaceæ*. This work is in folio, published in 1773, with 21 plates.

Retzius, Professor of Botany at Lund in Sweden, published in six *Fasciculi*, from 1779 to 1791, in folio, with 19 plates, many Indian plants discovered by travellers, particularly Kœnig, who visited both the Coromandel and Malabar coasts, as well as Ceylon and Siam.

Thunberg, in his *Flora Japonica*, has given descriptions and figures of many of the plants of Japan, several of which, or nearly allied species, are to be found in the Himalayan mountains.

Though not strictly Indian botanists, it is sometimes useful to refer to those who have written on the botany of neighbouring countries, especially Asiatic; and among the most useful of them may be mentioned the work of Forskal, on the plants which he found when travelling with Niebuhr, in Arabia. The Indian reader will be surprised to find so many names with which he is familiar: the Arabic names being given both in the English and the Arabic character, and without doubt introduced by the Mahomedan conquerors into India. Fr. Hosselquist travelled as a botanist in Syria; Olivier and Michaux in Persia, and Pallas in Siberia. Loureiro, a Portuguese, went as Missionary to Cochin China, but as he could not without medicine succeed in his plans, he studied the productions of the vegetable kingdom. The *Flora Cochin-chinensis*, edited by Willdenow, contains descriptions and plates of the plants he found in that country. Sonnerat died in 1813, after having employed 20 years in his travels; he visited the isles of France and Bourbon, Madagascar, the Philippines, Moluccas, New Guinea, the Coasts of Malabar and Coromandel in India, Ceylon and China. Many of his plants are described by Lamarck in his invaluable *Encyclopedie de Botanique*.

We now come to the time of the author of the present *Flora Indica*, who independent of many contributions to the transactions of learned societies, and to the periodicals of the day, was principally brought to notice by his work entitled *The Plants of the Coast of Coromandel*, which was published by the order, and at the expence of the Honorable the Court of Directors, the selection being made from five hundred drawings and descriptions presented by Dr. William Roxburgh, then their Botanist in the Carnatic. With a more immediate view to utility, preference was given to subjects connected with "medicine, the arts, or manufactures;" but new plants also were admitted, or such as had hitherto been imperfectly described, although their qualities and uses remained unexplored.

John Gerard Kœnig, a native (it is believed) of Courland, came to India in 1768, under the protection of the king of Denmark, chiefly for the purpose of studying the natural history of the country: he was prosecuting his botanical researches in the Carnatic, when Dr. Roxburgh, who entered the service at Madras in 1766, became acquainted with him. Dr. Roxburgh had applied to botany under Dr. Hope in the University of Edinburgh, and bringing with him to India a love of the study, he found in Dr. Kœnig an experienced conductor through a wilderness as yet unexplored by either.

On the death of Dr. Kœnig, Dr. Russel was nominated his successor; he contemplated the publication of a work on the useful plants of Coromandel, which though perhaps less generally interesting to the botanists in Europe, might prove of real service to India.

Circular letters, with a list of the plants proposed for the first publication, were sent by the Medical Board to the subordinate settlements, requesting it might be favoured with any information respecting the subjects in question, which the medical gentlemen might have it in their power to communicate; and in consequence several useful communications were received. Dr. Russel however left India before the proposal could be carried into execution. But as the object was approved of by the Court of Directors, the directions their letter contained fell fortunately into hands well qualified for carrying them into execution.

Our author, now disengaged from the duties of his station, was pursuing his favourite study at Somalcottah, when he thus became permanently attached to botanical pursuits. He had made experiments on the cultivation of pepper and indigo; had written on qualities of the *Swietenia bark*, and had communicated other discoveries, to the *Philosophical Transactions*, the *Indian Repository*, and the *Asiatic Re-*

*searches.* He had made large collections of plants in the Carnatic, and for several years previously to his appointment had retained a painter constantly employed in drawing plants, which he accurately described, adding such remarks on their uses as he had learned from experience or collected from the natives.

The drawings and descriptions arrived in England in 1791 and 1794, when the number of 500 were completed. It was from these that the first selection was made.

Sir Joseph Banks undertook the superintendence of the engravings, and Dr. Russel of the letter press, in consequence of Dr. Roxburgh's intended residence in India, as he was in 1793 selected to be superintendent of the botanical garden at Calcutta. After many years of laborious investigation he was compelled to visit his native country for the recovery of his health; but he died, as we learn from his son, at Edinburgh, in February, 1815.

The work now consists of 3 volumes, in large folio, with 300 plates drawn in a very superior style. They are selected chiefly for their useful properties, as may be observed in the long account given of the *Oldenlandia umbellata*, Chay root or East Indian madder; the numerous experiments shew the care that has been bestowed on the application of botany: also in the account of the sandal-wood tree, the Catamaran tree, *nux vomica*, cleaning nuts, the teak, several esculent species of *ceropagia*, marking nut, Sapan-wood tree, *Swietenia febrifuga*: the *mehwah* tree, the *butea frondosa*, with experiments on its gum; *embryopteris glutinifera*, *phœnix farinifera*, *areca catechu*, *feronea elephantia*, *Ægle marmelos*, *mimosa Arabica*, *Rottlera tinctoria*. Under *mimosa catechu*, it is observed, "but the natives have no idea of extracting from it, or any other, the extract called *catechu* (*terra Japonica*):" this is an inaccuracy, as large quantities of *catechu* are made from it in the upper provinces of India. *Terminalia chebula*, with directions for dyeing yellow: *Shorea robusta*, *Dipterocarpus turbinatus*, the Cardamum tree, *Scirpus tuberosus*, or water chesnut of the Chinese, *saccharum Sinense*: the *Sona* tree, *Gmelina arborea*, for fibres: observations on the different kinds of cotton.—The above list shews the number of useful plants, described and figured in the great work of Dr. Roxburgh, a work perhaps less known in India than in any other part of the civilized world.

It may appear that much time has been unnecessarily employed in noticing a work of Dr. Roxburgh's, which has no immediate reference to that now under consideration; but the fact is, that the two works, though published at such considerable intervals, are closely connected

together, form one whole, interpret each other, and are well calculated to give a correct view of his labors as an Indian botanist.

- The present work, containing descriptions of all the new plants which he had discovered, as well as notices of those which, though previously described, he had found in India, was completed many years ago, and the manuscript deposited with Dr. Carey, the venerated Editor of the work. An idea of the labours of Dr. Roxburgh may be formed by an inspection of the catalogue published by Dr. Carey, called the *Hortus Bengalensis*, and which may be considered an index to the present work. This was published in 1814, at the time that Dr. Roxburgh was obliged to make a voyage to sea for the benefit of his health, when Dr. Carey embraced the opportunity of his absence to bear testimony to those abilities, that zeal and success which had been so eminently displayed in bringing the Botanic Garden to its then state of perfection. We quote his words from the Government Gazette of August, 1831.

“The garden was begun by Colonel Kyd, in March, 1786, and collections of plants from different parts of the east were soon introduced into it with such success, that the number of plants brought into it in eight years amounted to more than three hundred. Dr. Roxburgh joined it in autumn, 1798. His unremitting attention to its improvement, and his eminent abilities as a botanist, are far more fully exhibited in the following catalogues than they could possibly be by any eulogium from a friend. The number of described species now in the garden amounts to 3500; for the knowledge of no fewer than 1510, as named and described in this catalogue, we are indebted to his indefatigable and discriminating researches. Among these are a great number of new genera, some of which have a considerable number of species ascertained; to these should be added those plants contained in the second catalogue which, though not in the Botanical garden, have been described and many of them accurately drawn by him: these amount to 453. The extensive correspondence which he maintained, not only with gentlemen in all parts of India but in most parts of the world, will be witnessed by the list of donors to the garden which he superintended; and the liberality with which he always communicated to those who applied to him, requires no other witness than the universal voice of the inhabitants of India, and even of many in Europe and America, to whom he constantly sent supplies. He was elected member of the following Societies:—Phil. Soc. and Linn. Soc. of Philadelphia,—Soc. Encour. Arts,—Roy. Soc. Physicians, Edinburgh,—Linn. Soc. London,—Roy. Soc. Edin.—Soc. Nat. Hist. at Berlin.”

The above extract gives a succinct view of the invaluable labours of Dr. Roxburgh, and though his work cannot be considered as an entire account of all the plants of India, yet it is a tolerably full one of what is commonly considered India, that is of the peninsula and of the plains of Hindústan; for in Dr. Roxburgh's time the north-western and hill provinces were little known, and Silhet, Assam, and Ava, had been, with the exception of the former, but little explored. It is still therefore, though completed so many years ago, the best work we have

on Indian botany, and the two volumes now published, give a true indication of the value of the two others, which are to follow immediately to complete the work. The *Hortus Bengalensis*, of which a reprint appears to be imperiously called for, gives a list arranged according to the Linnæan classification of all the plants which are described in Dr. Roxburgh's *Flora*. In this list, opposite the Botanic names, the Indian ones are given, together with the places of growth, names of donors, duration and habit, time of flowering and of seed, with frequent reference to figures of the plants, in the works of Rheede and Rumphius. A portion of this work, extending as far as nearly to the end of *Pentandria Monogynia*, was formerly printed, with which the invaluable additions of Dr. Wallich were incorporated. But as this volume of the work has been long out of print, and as the sons of Dr. Roxburgh were anxious that the *Flora Indica*, on which he bestowed so many years' unremitting labour, should be presented without any further delay to the scientific world, Dr. Carey, at their request, has superintended the progress of the present edition through the press: not considering themselves however at liberty to make use of Dr. Wallich's invaluable notes and additions, Captains Roxburgh have omitted them in reprinting the first part of the work. The present edition of the *Flora*, therefore, to be completed in four volumes, will consist of the manuscripts left with Dr. Carey by Dr. Roxburgh, without any addition. We therefore miss along with Dr. Wallich's additions Dr. Carey's various Sanscrit Synonymes, which added so much value to the former edition.

The volumes under review extend to the end of *Polyandria Polygynia*. From the nature of the work it is not easy to give an idea of its contents, except by mentioning that it contains descriptions in English of most of the plants usually found in India, exclusive generally of those of the hills, as far as the first thirteen classes. Dr. Roxburgh's high character as a botanist will be a sufficient warrant for the correctness of the specific descriptions. Generic characters were not so much or so accurately studied in Dr. Roxburgh's time, as they are now. The general reader may obtain a tolerable idea of their value by turning to the several articles where the useful properties of the plants are particularly described. In the first volume, we would particularly refer to the valuable notices respecting the several useful species of *Curcuma*, from one of which an excellent substitute for Arrow-root is procured;—the different kinds of ginger;—of cardamum;—the observations at p. 85, respecting the manufacture on the coast, of barilla;

—the superiority of the China sugar-cane, at p. 240, over that commonly cultivated in India ;—at p. 476, *Convolvulus Turpethum* used as a purgative by the natives of India ;—the observations on *Sapistanum*, at p. 589, and at 617, on *Scopolia aculeata*, as a cure for jungle fever. In the second volume *Nerium tinctorium* is mentioned as producing a kind of Indigo, and *N. tomentosum*, a yellow dye ; *Asclepias asthmatica* is highly spoken of as a substitute for ipecacuanha ;—the *Asclepias tenacissima* as yielding fine silky fibres, of which the mountaineers of Rajmahl make their bow-strings ;—*Asclepias tingens* is mentioned as yielding a green dye ;—*Salsolanudiflora* for the production of pearlash, and *Sansevieria zeylanica* as affording what is called China grass. Most of the Indian trees and plants, remarkable for any useful properties, are always indicated, and the native names being mentioned under the botanic ones, facility is afforded for obtaining any of the articles that may be required for experiment.

In conclusion it may be useful to indicate, that if the generic characters were all printed in a tabular form at the commencement of each volume, considerable inconvenience would be saved in discovering the genus of a plant with which we are unacquainted ; for instead of turning over to the generic characters throughout the volume, we should have them presented to us within the compass of a few genera. If the learned and highly venerated Editor should not consider it as coming within his plan to embrace our suggestion, we will in a subsequent number of the Journal offer in a tabular form all the genera contained in Dr. Roxburgh's four volumes of the *Flora Indica*.

#### IV.—*A Sketch of the Route and Progress of Lieutenant A. Burnes and Dr. Gerard.* By a recent Traveller.

[We have to thank our correspondent for the following sketch of the proceedings of two travellers, upon whose adventurous journey to explore the Oxus are directed the eyes of all who are interested in geographical research. The information is evidently drawn from private letters, but we trust, that the authors will not deem the publication of the extracts to which we have confined ourselves, premature, only because they were not expressly written for such an object.]

Before the travellers quitted the last civilized capital on the north-west, the splendid city of Lahore, so much celebrated for its palaces, gardens, and mosques, densely populated by an active and cheerful race, Ranjit Singh desired to leave an indelible impression on their minds of the splendour of his court. Dr. Gerard writes :

“ Our entertainment might be compared to those splendid feasts described in the Arabian Nights ; we were transported into a little paradise of pleasure ; the Maharaj himself tasted, in more senses than one, of the intoxication of the scene, and ere morning most of his chieftains and guests were ‘ hors de combat.’ ”

Having procured letters of introduction to the several chiefs who occupy the west bank of the Indus, and provided themselves with *húndis* to an ample amount on the *kotís* of Peshawur and Kabúl, the travellers left Lahore about the beginning of March. In their progress towards the Indus, they visited the great salt range which stretches between the Indus to the Jelum, and made a considerable deviation from the straight road to visit *Dádan Khán*, where some of the chief excavations of the article exist\*.

While on the banks of the Jelum, they were much struck by the immense size of the firs floated down the river ; the houses in all the towns along its banks are roofed therewith. Immense cedar trees were seen rolled down from the hills ; it was these that supplied materials for Alexander's fleet : one tree measured thirteen feet in girth, which may afford some idea of their applicability to ship-building.

From *Dádan Khán* they went to *Darapúr* on the Jelum, but notwithstanding a very active search they failed to discover the remains or site of the city of Bucephalus, founded by Alexander, in honor of his famous charger. The celebrated fortress of *Rotas*, is situated a short distance to the west of the town and river of Jelum, near a broad sandy stream, which contains little water. This fortification was built by the well known Patán emperor Shér Shah, who expelled Hamayún, the son of Baber Shah, from the throne of Delhi.

Lieutenant Burnes and Dr. Gerard halted one day to look at this noble fortress, but they deem it, “ with all its formidable extent, a piece of stupendous folly.”

The next place of interest the travellers visited, was the tope of *Manikyálu*, the history of which ancient structure still remains a problem. They obtained many coins with devices apparently Grecian, from the peasants of the neighbourhood†. Dr. Gerard observes, that although the probable inference is, that from “ any of the memorials which have been discovered, the tope marks the site of the town of Taxilla, the appearance of the building does not accord with so great

\* An account of these mines by Lieut. Burnes will be found in the present number.

† Three of these coins, and impressions of one more and of two ancient gems, have reached us, which in addition to the coins discovered by Colonel Ventura, are now under investigation.—ED.

antiquity. Two thousand years make sad havoc in masonry ; it is more likely that it belongs to the Bactrian dynasty." The construction, the figure, and isolated situation of the tope of *Manikyāla*, is certainly of a singularity to attract the attention of all travellers ; but there is nothing in the mere workmanship that would lead one to suppose, that it may not have been executed by the inhabitants of the neighbourhood. This is perhaps satisfactorily proved from the existence of several monuments of the same shape, on the west of the Indus, and from a comparison with an ancient building in the immediate vicinity. The building alluded to is a saint's tomb, surrounded by a stone wall, about a mile from the tope to the southward. The building material is the same ; a porous limestone, which is dug out within a short distance of the surface of the ground, in fact indurated *kankar* : similar specimens of which are to be met with in various places between the Jumna and Ganges. At the Khyber pass, on the road from Peshawur to Kabúl, another tope of much the same construction is found ; as likewise at Balabágh beyond Jelalabad, on the same road. Without comparing all these edifices together, we cannot very well form a correct opinion ; but it may be doubted whether either the Grecian or Roman edifices, which have survived the wreck of time, can furnish an example at all corresponding to the tope of *Manikyāla* ; and if such a doubt proves to be true, we can scarcely longer abstain from giving the people of the country credit for erecting this mausoleum, for such we take it to be, as there is no evidence of its utility to men who are alive. After leaving this place, they visited Ráwal Pindí, a large and well inhabited town ; it was here that Shah Sujah passed a considerable time after being expatriated ; it is situated near the mountains, and the climate is excellent. "There are many pleasant vallies in the neighbourhood ; but what conveyed most gratification to the travellers was the enchanting wild and beautiful garden of Hosein Abdaleh, situated under the brow of a mountain, copiously watered by streams of clear transparent water, decorated with all sorts of exotic flowers, shrubs, and plants ; it was here they reposed their weary limbs ; they found rest and stillness in this mansion of delight and tranquillity ; they remembered a pleasing description of it in Lalla Rookh, but regretted they had not the book to ascertain how far the picture corresponded with the original. They were surprized with the variety and number of trees ; the romantic nature of the scenery ; the rich verdure and the tout ensemble made them feel as if they stood on English ground : but desolation was worn by every thing visible ; the garden mourned and had put on its



weeds of woe ; summer houses and once gay retreats were tumbled from their exaltation ; they were in heart-sickening ruin. Even the trees suffered grief and vexation ; a violent tempest a few years before had up-sooted some of the finest, and they now lay low with their drooping heads in the water." At the town of Hosein Abdali, is a saint's tomb, around which is a fine stream of water full of fish. One of the great roads to Kashmír passes this place, and strikes into the hills, bringing the traveller to Kashmír in seven days. After leaving Ráwal Pindí, a causeway cut through a hill is passed ; it is excellent of the kind, but one does not exactly feel convinced of the important utility assigned it. In the centre of it, on one of the walls, is a Persian inscription, denoting that it had been constructed in the time of Shah Jehan ; but much of the context was obliterated. From Hosein Abdali our travellers made their way towards the Indus ; here they were met by Hari Sinh, who shewed them every attention.

It is now necessary to advert to the nature of the country passed between Lahore and this river. Between Lahore and the hills, on which stands *Rotas*, is an uninterrupted level plain, confined by the Himalayan branches of hills on the north, and various chequered and intersected plains on the south. They passed over the three principal streams of the Panjáb ; the Ravi, the Chináb, and the Jelum, and the most populous and best cultivated part of the Panjáb. The country, &c. as far as *Rotas*, in appearance resembled Hindústan : the people, their customs, their houses, their crops and cultivation, their dress, all appeared but little modified. The flatness of the country, the aspect of their towns and villages, surrounded by groups of trees, gave little or no indication of change ; but beyond *Rotas*, the country assumed broken and highly contrasted features ; small ranges of hills met them on the right and left ; small streams were frequently passed. The elevation of the country, according to Dr. Gerard's barometric observations, now became above two thousand feet above the level of the sea. The climate was materially modified, and they even experienced hoar frost, and sand \*ice, as late as the 10th and 12th of March. The climate was good, and the air temperate all day. With the nature of the country, the inhabitants also seemed less polished, severer in their manners, and less easy in their circumstances ; the population was also scantier, the villages fewer, and far between : the northern hills now frowned more immediately upon their course, and tended to increase the comparative desolation of the country ; the stories of the murderous *Gakers*, the tales of the successful resistance or easy conquest of the strong places they passed, harmonized with the scenery. They now felt

that they were really beyond the boundary of Hindústan. Our travellers prepared themselves now for the assumption of the native dress, and began gradually to accustom themselves to the adoption of oriental manners and customs. This was done to secure them from attracting notice, and thus ensuring their personal safety, and a free intercourse with the people of the countries through which they might pass. Dr. Gerard writes : " After leaving Lahore, we began to assume the native costume, and divest ourselves of the cumbrances and comforts of civilized life, and we are now (Atok, 16th March,) in every respect in a suitable condition to mingle with the Afgháns, and even to encounter robbers. Our poverty will however protect us ; our beards are growing, and our faces are getting black from the sun's ardour. Our habits cannot be too coarse to correspond with our vagrant character. I wish other parts of us besides our face would change colour, as we are liable to be betrayed by our awkward attitudes. Our shirts stick close to our backs, as we cannot afford their renewal ; in fact our clothes are still too good, and the sooner they become greasy the better. Two mules carry all our baggage and servants : our beds are upon our horse rolled up like a pedlar's pack. By and bye we shall mess with our servants, of whom we are already a counterpart ; and when we say our prayers five times a day, and use our fingers for chopsticks, we shall pass on unnoticed. We have parted with every superfluity ; it was with regret however that I gave up two of my spare barometer tubes :—the instrument still remains, and if I am so fortunate as to get an observation on the *Hindú kush*, I shall be satisfied ; in case of fracture, our thermometers will still give approximate altitudes."

Having reached the Atok, they were welcomed by Hari Sinh, whom they found encamped in the plain of the Indus ; they paid him a visit in his tents, which brought back the scenes of Lahore grandeur. Hari Sinh having forded the river the previous day, they were determined to try the same experiment, and accordingly proceeded on elephants with him ; but the enterprize cost them the sacrifice of a man and two horses ; the people struggled, and losing the ford, were swept down by the rapid stream : seven sawars lost their footing, but all were recovered, except one. Their elephant rolled deeply, but never had occasion to swim ; the next branch of the river was more difficult, but they prevented the horsemen following them ; in recrossing, they kept in close order, and repelled by this means the impetuosity of the current. This stream has been frequently forded by the armies of the Sikhs in latter times with little or no loss of lives. Our correspondent says, that "Atok has

lost much of its repute as a place of strength, since the fords have become so greatly known. Elphinstone speaks of Shah Shujah's passage as a prodigy, and the first of the kind. The Sikhs who accompanied us in our passage, being predestinarians, undertook the fording of the Indus without concern, saying they were accustomed to it."

Lieutenant Burnes writes, that the sand of the Indus, near Atok, yields a small quantity of gold\*: the process of extraction by repeated washings is very tedious. Quicksilver is employed to take up the gold, by amalgamation, from the coarser grains which remain on the sieves. Some of the smaller rivers falling into the Indus are said to contain more gold than the latter.

The same traveller also describes a curious phenomenon observed at the confluence of the Indus and Kabúl rivers, half a mile from Atok, (for Macartney's map is here in error,) in the following words: "An *ignis fatuus* constantly shews itself in this place; two, three, and even four lights are visible at a time, and continue to shine through the night. It appears at first sight to be the reflection of the water on the rock, well smoothed by the current; but then it only shews itself in one particular spot, and though the whole banks are so smoothed, it is confined to a few yards. There was and could be no deception: the natives cannot account for it, and its continuance during the rainy season is the most inexplicable part of the phenomenon in their estimation. The valiant Mán Sinh, who carried a war of revenge against the Mahomedans beyond the Indus, fought a battle on this spot, and the lights are considered by some as the departed spirits of the slain. For my own part I cannot solve the mystery regarding this "Will o' the wisp," which I only credited after having seen it." The water of the Indus has the reputation of being specifically cold, but this is a vulgar error arising from the relative difference of temperature between the river and atmosphere. On the 18th March it was 22° Farh.

While at Atok, our travellers received friendly letters from the chief of Peshawur, Sultan Mahomed Khan, and they were the more acceptable as they had not sent information to him of their approach. For this civility they believe they were indebted to Shah Shujah; however they would have rather wished that it had been omitted, as it was scarcely their intention that their progress should be made a matter of notoriety. While on this subject, Dr. G. makes the following remarks: "It is quite ridiculous to view ourselves as natives, while every other person sees through the thin veil of dissimulation; we

\* A specimen has reached us in safety.—Ed.

are however passing the best way for our safety and comfort, by appearing in the dress and habits of the country, by which we shall avoid the idle gaze and intrusions of the moh, the importunity of beggars, and the reckless cupidity of robbers. It is impossible for one to assume disguise who has been long at the court of Ranjít Sinh, and who continues to be treated as a Sahib to the very limit of his authority; but it never was our intencion to mask ourselves. Sultan Mahomed Khan is going to send horsemen to meet and escort us, which is rather too much kindness, and he will only disgrace himself by caressing such dirty disreputable fellows as we now appear." Ranjít Sinh's troops stationed in this fort made some opposition to the baggage of the travellers being ferried across; the fact was, they were in a state of mutiny in consequence of large arrears being due to them. They crossed shortly after to the opposite side of the river, on which is situated the fort of Khyrabad. On the 10th, they were at Akora, on the banks of the Kabúl river, preparing for their onward journey to Pesháwar. S. E.

*Allyghur, 11th April, 1832.*

V.—*Some account of the Salt Mines of the Panjáb. By Lieut. S. Burnes, Bombay Army.*

*Locality.*

In the high lands of *Kabúl*, between the city of that name and *Pesháwar*, a range of hills springing from the roots of the white mountain (*Suféd Koh*), crosses the Indus at *Hara-bágh*, and terminates on the right bank of the *Jelum*, or Hydaspes of the ancients. This range formerly figured in our maps under the name of *Jood*, after it had passed the river; but it has been more appropriately denominated the salt range, from the extensive deposits of rock salt which it contains. An account of that part of it near *Harth-bágh*, where the Indus in its course southward cuts this range and lays open its mineral treasures, will be found in Mr. Elphinstone's work. In the neighbourhood of *Pind-Dádan-Khan*, a town about 100 miles N. W. of Lahore, the salt mines which supply the northern provinces of India with that necessary of life are excavated in the same range. The following particulars pretend not to rank as a scientific account of these mines, my only object being to convey that information which a journey to so unfrequented a part of the Panjáb has enabled me to collect.

*Formation.*

The salt range forms the southern boundary of a plateau between the Indus and Hydaspes, which rises about 800 feet from the plains of the Panjáb. The hills rise to an actual height of about 1200 feet from the valley of the *Jelum*, which gives them an elevation of about 2200 feet from the sea. They exceed five miles in breadth. The formation is sandstone, occurring in vertical strata, with pebbles or round stones imbedded in various parts of it. Vegetation is scanty, and the bold and bare precipices, some of which rise at once from the plain, present a frightful aspect of desolation. Hot springs are found in various places. Alum, galena, and sulphur also occur; but a red clay, which is chiefly found in the valleys, is a sure indication of a salt deposit, and it is to be found at intervals throughout this range\*. The supply of the mineral is now drawn from *Pind-Dádan-Khan*, whence it can be conveyed with facility both up and down a navigable river.

*Mines.*

At the village of *Keorn*, five miles from *Pind-Dádan-Khan*, we examined one of the principal mines. It was situated in a valley near the outside of the range, which was cut by a rivulet of salt-water. It opened into the hill through the red clayey formation above mentioned, at a distance of about 200 feet from the base. We were conducted by a narrow gallery, sufficient to admit of one person passing another, for about 350 yards, of which fifty may be taken as actual descent. Here we entered a cavern of irregular dimensions, and about an hundred feet high, excavated entirely in salt. The mineral is deposited in strata of the utmost regularity, occurring like the external rock in vertical layers. Some of them however subtend an angle of from 20 to 30 degrees, and have the same appearance as bricks that have been placed upon one another. None of the layers exceed a foot and a half in thickness, and each is distinctly separated from its neighbour by a deposit of argillaceous earth, about an eighth of an inch thick, which lies like mortar between the strata. Some of the salt occurs in hexagonal crystals, \*but oftener in masses; the whole of it is tinged with red, varying from the slightest shade to the deepest hue;—when pounded the salt is white. The temperature of the cavern exceeded that of the open air by 20 degrees, when the thermometer stood at 64° (in February). The natives state that these mines are much colder in the hot season, but this only shews that they undergo little or no alteration, while the heat outside increases as the season advances.

\* We have safely received the specimens of these minerals transmitted by Lieut. Burnes.—ED.

*Mode of working.*

There were upwards of an hundred persons, men, women, and children, at work in the mine, and their little dim burning lamps on the sides of the cavern and its recesses shone with reflected lustre from the ruby crystals of the rock. The cavity has been excavated from the roof downwards. The salt is hard and brittle, so that it splinters when struck with the sledge-hammer and pick-axe. The rock is never blasted with gun-powder, from fear of the roof falling in; and accidents of this kind sometimes happen in the present simple mode of excavation. The mines are not worked for two months during the rains for the same reason. The miners live in villages among the hills. They have a most unhealthy complexion, but do not appear to be subject to any particular disease. They receive a rupee for every 20 maunds of salt brought to the surface; a task which may be performed by a man, his wife, and child, in two days. In those mines, where the mineral is near the surface, it is hewn into blocks of four maunds, two of which load a camel, but it is usually broken in small pieces. This salt holds a high reputation throughout India with native practitioners, from its medical virtues. It is not pure, having a considerable mixture of some substance (probably magnesia), which renders it unfit for curing meat. The natives of the Panjáb ascribe the prevalence of *nazla* to its effects. That disease is said to consist of a running at the nostrils, which wastes the brain and stamina of the body; with what truth I know not.

*Supply.*

As the salt range contains a supply which is inexhaustible, the mines yield any quantity that may be desired. Two thousand five hundred maunds of Lahore, one of which is equal to one hundred pounds English, are extracted daily, which gives about eight lacs of maunds for the year. A few years since this salt was sold at the mine for a half and even a quarter of a rupee per maund, but its price has been now raised to two rupees per maund, exclusive of duties. It is closely monopolized by the Panjáb Government, and Runjít Singh hopes to derive an annual revenue of sixteen lacs of rupees, with  $2\frac{1}{2}$  additional for the duties. A lac and a half of rupees however is expended in working the mineral. The profits amount to about 1100 per cent. though the salt is sold for one-third the price of that of Bengal, which averages 5 Rupees per maund of 80 lbs.\* The Panjáb salt is exported by the *Jelum* to *Multan* and *Bhawalpúr*, where it meets that of the *Sámar* lake. It finds its way to the banks of the *Jumna* and to *Kashmír*, but it is not exported

\* Vide Mr. Ramsay's Evidence before the Committee of the Lords.

westward of the Indus. Runjít Singh has prohibited the manufacture of salt in all parts of his dominions, yet it is very questionable if he will ever derive so large a revenue from it as he now expects. The farmer of the monopoly, a cruel and tyrannical man, is now mercilessly oppressing the people to extract it. The natives do not know the period at which these mines were first worked, but it must have been at an early date, since the mineral is laid open by the Indus. They were used by the Emperors of Hindústán, but the inquiring Baber does not mention them in his Commentaries.

*VI.—Mode of extracting the Gold Dust from the Sand of the Ningthee River, on the frontier of Manipúr.*

[Extracted from Captain Grant's Letter to Mr. G. Swinton, dated Manipúr, 1st March, 1832.]

Read 4th April, 1832.

I forward a specimen of the gold found in the sand of the Ningthee river, and partly extracted in my presence. The process is very simple, as is also the apparatus employed; the latter consists of a plank four feet in length, two and a half wide at the upper end, and tapering towards the lower one, which is one and a half; it is hollowed out so as to leave an edge of half an inch round the sides and upper end, the under end being left open for the water to run off; the lower half of the plank is cut into a succession of grooves half an inch deep and the same in width. This plank is placed slightly sloping towards the lower end, and the sand washed through a coarse sieve which frees it from the pebbles and gravel: the fine sand which remains in the grooves of the plank is then placed in a wooden trencher, polished on the inside with *keoo*\*, and in shape and size resembling a shield, with a very small receptacle in the centre: this is immersed so as to leave its outer edge on a level with the surface of the water, and by a rotary motion, the fine sand is washed off and the gold remains in the small receptacle. The whole operation occupied about a quarter of an hour, and the quantity of gold found was about a grain troy weight. Gold is found in greater abundance at most other places, where searched for in the sands of the Ningthee, than at Helao, where I witnessed the process; it is also only found where the sand is mixed with pebbles and gravel: the black sand, which accompanies it, is invariably found with the gold; its appearance, in fact, denotes the pre-

\* The black varnish of the keoo tree, which grows in the Rutboo valley, supposed by Dr. Wallich to be the same as the varnish tree of Ava. G. S.

sence of the latter. I also forward a specimen of an ore which is abundant in the bed of the Maglung ; being no mineralist, I will not venture to pronounce an opinion as to the nature of the metal it contains\*. I inquired of the *kubas*, who could give me no information on the subject. I enjoyed a coal fire every evening during my progress up the Maylung ; it burned well, but the smell was somewhat strong ; there are quantities of it to be found in all parts of the bed of the nalá, the *kubas* say it is petrified teak charcoal : an opinion in which I am inclined to agree, as I saw immense logs of that timber, which were undergoing the change to petrification ; and parts which were partially burnt, were to all appearance the same as the coal. I have got specimens of the coal and petrified teak, but do not send them, having sent some four or five years ago, to Mr. Tucker ; I also perceived a notice on the subject by Dr. Richardson : should you wish it, I will send them on hearing from you. The *kubas* and *nagas* use the petrified teak for striking fire to tinder ; there is one peculiarity respecting its locality which struck me, it is that I have only observed it (in all places between Mulphoo and Sunayachil), at about the same distance from the Ningthee, that is, at the foot of the last range of the Augoching hills on their eastern side.

#### VII.—*Note on Indian Saline Deposits.* By the Reverend R. Everest.

[Read in the Phys. Cl. on the 4th April, 1832.]

Some months ago I had the honour of laying before the Society my views respecting the deposits of common salt in the soil of the *Bundelkhand* country, as mentioned by Capt. Franklin, and also those of the *Bhartpúr* district, as mentioned by an anonymous writer, in the *GLEANINGS*. I then ventured an opinion, that these deposits were not to be considered as characteristic of the new-red-sandstone, partly because their chemical composition differed from that of the rock-salt deposits in Europe : the *Bhartpúr* deposits being stated to consist of muriate, with some sulphate and carbonate of soda ; the rock-salt of Cheshire, on the other hand, being composed principally of muriate of soda, with some sulphate of lime ; and partly, because it was in no wise proved that these deposits were connected with the sandstone formation itself, further than by their existence in the superincumbent soil. I now beg to call your attention to the newly discovered saline deposit in the plain

\* Iron pyrites.



about a mile to the west of this, as confirmatory of my previous opinion. The salt is principally composed of carbonate, with a mixture of sulphate and muriate of soda. It effloresces on the surface in the dry weather, and is scraped off by the natives. I had the soil opened above a foot in depth, and it appeared to be equally impregnated beneath.

This deposit is not connected with any sandstone, and is 35 miles distant from the nearest point of the great sandstone formation of *Bundelkhand*. From inquiries I have made, I am led to believe, that similar saline deposits are not unfrequent in this district. Capt. Franklin mentions salt in the valley of the Ganges beyond *Mirzapūr*, and the salt of the *Bhartpūr* district is not proved to be connected with the sandstone; therefore we have no reason to believe it peculiar to any formation. As the sulphate of soda is said to be collected in large quantities from the soil of the basaltic districts on the western side of India, it is not improbable that these saline deposits are distributed over the peninsula of India co-extensively with the nodules of *kankar* (carbonate of lime) and hydrated iron ore.

*Ghazipur, March, 1832.*

### VIII.—*Smelting of Iron in the Kasya Hills.*

The following is the method pursued from time immemorial by the natives of this part of the country in working down the ores of iron so plentifully met with hereabouts.

There are large grass huts at least twenty-five feet high, the thatch of which reaches down to the ground on all sides. The interior, of an oval form, 15 by 30 feet, in the two diameters, is divided into three apartments; the central one being the smelting room.

Two large double bellows, with the nozzles pointed downwards, are set upon one side of the apartment, on the upper part of which a man stands with one foot on each, his back supported by two planks. He holds a stick in his left hand, which is suspended from the roof, and has two strings attached to it below, connected with the two bellows: these are worked quickly by a wriggling motion of the loins, and the strength of the leg.

The nozzles of the bellows unite in a tube which leads underground, from a sort of wind chest, to the hearth about four feet in front of them. Over the hearth is a chimney of pipe-clay braced with iron hoops, two feet in diameter at the bottom, and about six feet high. The mouth at bottom is on the side away from the bel-

lows, and the chimney inclined from them to direct the heated air from the smelter towards an opening in the roof. At the right side of the bellows and even with the top of the chimney, is a trough containing damp charcoal and iron-sand: at every motion of his body the operator with a long spoon tumbles a piece of this charcoal with the iron-sand adhering to it, down the funnel of the furnace, and when a mass of melted or rather softened iron is formed on the hearth, it is taken out with tongs, and beaten with a heavy wooden mallet on a large stone by way of anvil. The iron in this state is sent down to the plains for sale or barter. The smelters say that they procure their fire-clay in large quantities from the vicinity of the limestone hill at *Chirra Púnjé*, whence on a former occasion I sent you a series of geological specimens, among which, if I remember right, was some of this clay, of a light straw colour and slaty texture, containing minute micaceous particles.

W. C.

### References to Plate VI.

1. The chimney of the furnace supported by stone pillars, so as not to touch the hearth.
2. One pair of bellows open.
3. Ditto shut.
4. Frame on which the man rests.
5. A primitive ladder for mounting the bellows.
6. The wooden mallet.
7. The tongs.
8. The spoon.
9. The trough supported by a wooden fork.

### VII.—On Chinese Vermilion.

[Translated into French from a Chinese Technologic Encyclopedia, entitled, *Thian-koung Kái-we*, or *Exposition of the Wonders of Nature and the Arts*. By M. Stanislas Julien\*.] From the *Nouveau Journal Asiatique*.

*Cinnabar*, liquid silver, the red of silver, are in reality one and the same thing. What causes them to bear different names is that the substance is either pure or coarse, or old or recently extracted.

*Cinnabar*, of the first quality, comes from *Chinpé* (now *Mayang*), and from *Sitchouan*. It is found in a state of purity in the bosom of the earth, and does not require purification by fire. This *cinnabar*, which is used to polish the tips of arrows, metallic mirrors, &c. is thrice as valuable as mercury: whence it is carefully picked and sold under its native form, that is, in the state of sand or red powder. If melted, it loses a great part of its value.

\*The Chinese edition whence this article is extracted bears the date of 1637.

The coarse cinnabar, of the second quality, needs to be purified by the fire, when it forms mercury.

The cinnabar of the first quality is found by digging the ground at a depth of 70 feet. The presence of the mineral is indicated by the appearance of small white granular stones. The largest pieces are of the size of an egg. The second sort does not enter into any pharmaceutic preparation. It is ground up and used by the painters and colorists in the same manner as that which is prepared directly from mercury. Its matrix does not always appear under the form of white stones, but has sometimes a mixture of blue and yellow. It is found about 20 feet below the other. Sometimes it is met with in a stratified sandy soil, and then the stony and sandy gangue is easily separated. This kind of cinnabar is found in abundance at *Koucitchou Ssein*, at *Thoung-jin*, &c. also in great quantities at *Changtcheou* and at *Tsintcheou*.

The cavities from which the second sort is collected, have a whitish aspect. When recently extracted, it may be separated without the necessity of previous pounding. This cinnabar, on first coming from the mine, has a brilliant surface, which soon tarnishes on contact with the air.

To prepare the vermilion, they take the cinnabar, and pound it in an iron mortar shaped like a boat, with a stone pestle of a flattened spherical form, and placed at the end of a vertical lever moved by four men, by means of a bar which passes through it. The powder is thrown into clean water, and left to soak for three days and three nights. One part falls to the bottom of the vessel, the other, lighter, floats on the surface: this is removed with a skinning ladle and placed in a second vessel. It is then called *Fult chou*, or *second red*. The cinnabar which was deposited in the first vessel, is taken out, dried in the sun, and is then called *Theout chou* or *first red*.

To obtain quicksilver from the ores, either the second quality, inferior cinnabar, white and newly extracted, or the deposit, or the skum separated on the surface of the water, are employed.

Thirty pounds of one of the above ores is put into an iron vessel, with a convex head of the same metal, having a small opening in its centre: the two are carefully luted together, and a curved iron tube fitted hermetically into the aperture at top, with hemp and luting.

Thirty pounds of charcoal are necessary for the distillation: when the retort becomes hot, one end of the iron tube is plunged into cold water, so that the vapour which rises from the metal pot distils over through the tube, and condenses in the water. In five hours the whole of the cinnabar is transformed into mercury, which is taken out of the water after having been suffered to repose for 24 hours.

Sometimes the mercury is treated afresh, to be converted into vermilion, which is then called *Intchou*, that is to say *red of quicksilver*. A retort of porcelain, or a double vessel of metal, are employed indifferently for this purpose: to one pound of mercury two pounds of sulphur are added; the mixture is triturated until it forms a blackish powder: it is then put into the crucible, which is covered with an iron cover, held down by a bar of iron laid across the top of it, and tied down on either side to the lower vessel by means of a loop of brass wire made fast round the latter. All the openings are then carefully closed with lute, and the pot is set upon an iron tripod, under which a fire of resinous faggots is maintained for a considerable time; whilst the cover is kept cool with an old swab soaked in water. The mercury then combines with the sulphur, and sublimes in a very fine powder, which adheres to the sides of the vessel. The cinnabar which fixes on the inside of the cover is of the brightest colour. When the vessel is quite cold, the vermilion is taken out. The excess of sulphur is found precipitated to the bottom, and may be employed a second time. One pound of mercury gives 14 ounces of cinnabar of the first quality, and  $3\frac{1}{2}$  oz. of the second quality.

The cinnabar obtained by the action of fire, and that from the pulverized native ore, have exactly the same appearance; nevertheless the former is never used in painting the houses of princes and persons of distinction: the only sort employed for this purpose being the pure pulverized mineral from *Thoung chin* and *Pe-tchouan*.

When intended to be used in writing, the vermilion is ground up with gum and made into small cakes. Rubbed upon a stone palate (*encrier*,) it presents a red of the richest brilliancy: if pounded on a tin slab, it forms a black colour, and is then fit for the varnishers, and gives to objects a glistening tint which enhances their price. Mixed with the oil of the *Thoung* tree, it assumes a very bright appearance: but if varnish be added to this, it loses its brilliancy and becomes of a deep black colour.

Thus we have described faithfully all that concerns the preparation of native and artificial cinnabar, as well as that of mercury. All that has been said about *the sea of cinnabar* and *the vegetable cinnabar* rests on no foundation whatever: they are mere reveries fit to amuse the credulous and lovers of the marvellous.

When mercury has been converted into vermilion, it has no longer the power to return to its original state, because it has then arrived at what may be called *the final limit of transformation*.

**X.—Abstract of Meteorological Tables, kept at Bancoora, by  
Mr. J. MacRitchie, for 1830 and 1831.**

1830.

| Months.        | Ther. lowest<br>24 hours. | Ther. highest<br>24 hours. | Barometer.<br>Noon. | Rain in inches. | Prevailing<br>Winds. | Occasional observations.  |
|----------------|---------------------------|----------------------------|---------------------|-----------------|----------------------|---|
| January.....   | 62.8                      | 71.7                       | 29.890              |                 | N. W.                |   |
| February.....  | ab                        | sent                       |                     |                 |                      |   |
| March.....     | 78.2                      | 85.1                       | .678                | 03.50           | N. W.                | 1 Foggy mornings. Hail-storm on 26th, stones 9 min. diam. Total Eclipse of ☾. |
| April.....     | 82                        | 88.4                       | .610                | 2.370           | S. W.                |   |
| May.....       | 84                        | 90.5                       | .471                | 5.627           | W. N. W.             | Very cloudy and rainy.  |
| June.....      | 85                        | 89.8                       | .331                | 8.600           | W.                   | Rains set in on the 6th, with severe thunder, lightning, and rain.            |
| July.....      | 81.5                      | 9.2                        | .425                | 15.506          | W.                   |   |
| August.....    | 83.3                      | 9.                         | 4.62                | 6.908           | S. E.                |   |
| September..... | 85.                       | 9.2                        | 5.00                | 4.784           | N. W.                | Total Eclipse of ☾ visible on 3rd.  |
| October.....   | 83.                       | 87.5                       | 6.37                | 1.672           | W.                   | Stormy 2 days.  |
| November.....  | 73.1                      | 81.6                       | 6.25                | .963            | N. W.                |   |
| December.....  | 61.6                      | 70.                        | 89.5                |                 | N. W.                |   |
| Yearly aver.   | 78.5                      | 81.7                       | 29.592              | 16.801          | N. W.                | On surface generally variable.  |

1831.

|                         |      |      |        |        |          |  |
|-------------------------|------|------|--------|--------|----------|--|
| January.....            | 66.5 | 73.  | 29.871 |        | W.       | A distant Comet visible for 10 days.   |
| February.....           |      |      |        | 3.000  |          | Partial Eclipse of moon on 26th.   |
| March.....              | 73.5 | 79.9 | .718   | 1.612  | N. W.    |  |
| April.....              | 83.1 | 8.1  | .610   | 4.397  | W.       |  |
| May.....                | 87.  | 92.8 | .510   | 0.300  | W.       | Very hot and dry generally.  |
| June.....               | 86.5 | 91.2 | .370   | 15.989 | N. W.    | Rains set in heavily on the 9th.   |
| July.....               | 85.5 | 89.7 | .385   | 10.987 | W.       |  |
| August.....             | 85   | 87.5 | .345   | 11.286 | S.       |  |
| September.....          | 82.5 | 87.5 | .538   | 10.259 | E. S. E. |  |
| October.....            | 81.2 | 87.2 | .600   | 5.854  | N. E.    | Rains broke up on 31st, with a violent hurricane, for 12 hours, from 6 p. m. to 6 a. m. 1st Nov. |
| November.....           | 70.  | 78.  | .685   | 4.160  | N. W.    | Bar. ranged from 29.5 to 28.8.   |
| December.....           | 69.5 | 73.5 | .810   | 1.438  | N. W.    | Torrents of rain. Trees torn up. Extraordinary cloudy and rainy month for the time of the year.  |
| An. Mean,               | 79.1 | 84.4 | 29.588 | 69.652 | W. N. W. | On surface generally variable.   |
| Mean of 2<br>years..... | 78.8 | 84.5 | 29.590 | 58.228 | W. N. W. | Range of Bar. from 29.920 to 28.800.   |

The Thermometer I observe by is a self-regulating one by Carey, and seems to answer the purpose very well. The Barometer is one of Bate's Marine ones. The rain-gauge is made by Knight.

## XI.—MISCELLANEOUS NOTICES.

*Extracts from a Native Receipt Book.*

The following receipts may prove highly useful to such of your correspondents as are engaged in Indian field sports, and can appreciate the advantage of being their own *elephant doctors* when professional advice is not procurable; they are extracted from the nostrums of a first-rate Delhi mahout, and I have had an opportunity of trying most of them at different times in my sporting days, when I made a point of attending personally to the comforts and welfare of my noble sporting companion. Should these receipts prove useful to fill a vacant sheet occasionally, I shall be happy to continue the supply. W. L.

*Medicines, &c. for Elephants.*

1. When an elephant's back is swollen, and it is necessary to cut it to let out the matter, the wound is to be well cleansed with the following, previously to filling it with No. 2. Make an extract from the root of the madár, add thereto 1 chittak of salt and 1 cowrie weight of ní'a tútia, to be removed every evening for about 8 days, to cleanse the inside well; then fill it with No. 2 for about 16 days, removed twice a day, at first for 8 days, and afterwards once in 8 days, and the upper part of the wound and swelling to be well anointed with the salve No. 2. No. 3 to be then sprinkled well over the wound twice a day.

2. *Salve for the sore back.*

|  |              |
|--|--------------|
| Musabbar, [aloes].....                     | 4 chittaks   |
| Sindúr Guzaráf, [red lead].....            | 2 ditto      |
| Olive Oil.....                             | 4 ditto      |
| Chota jewarkhatta, [flower of barley]..... | 2 seers      |
| Karwa tîl, [mustard oil]....               | 1 seer       |
| Níla tútia, [blue vitriol].....            | 2 chittaks   |
| Wax.....                                   | 2 ditto      |
| Oilum.....                                 | 1 cowrie wt. |

3. *To dry up the sore.*

|   |            |
|---|------------|
| Nutmegs.....  | 2          |
| Lachís, (cardamums).....                              | 1 chittak  |
| Dár-enáí, [cinnamon].....                             | 1 ditto    |
| Isafgel, [ <i>Plantago</i> ].....                     | 1 chittack |
| Tukhm-Balang, ( <i>Dracosephalum Royleanum</i> )..... | 1 ditto    |
| Sang jarábal, (alum?).....                            | 1 ditto    |
| Paprá kat, (white catechu).....                       | 1 ditto    |

To be finely powdered and sifted through fine cloth, and to be applied to the wound to dry it up.

4. *Lotion for inflamed eyes, &c.*

Rab-ul-sus or liquorice to be soaked in water in an earthen pot, and to be beaten to a strong froth with the hand, and as it subsides is to be taken up and thrown upon the elephant's eyes; this is very cooling.

5. *Ditto another.*

|                                 |            |
|---------------------------------|------------|
| Poppy heads.....                | 4 chittaks |
| Dhania, [coriander seed].....   | 4 ditto    |
| Sounph, [ <i>anethum</i> ]..... | 4 ditto    |
| Nousádar, [sal ammoniac].....   | 4 ditto    |
| Salt, Bherí, [black salt].....  | 4 ditto    |
| Salt, Sárar.....                | 4 ditto    |

To be steeped in water for 4 days in the shade in an earthen vessel.

6. *Ointment for swollen and inflamed eyes.*

|                               |             |
|-------------------------------|-------------|
| Sabzi, [hemp leaves.].....    | 4 chittaks  |
| Phitkari, [alum.] .....       | 1 ditto     |
| Opium.....                    | 1 pysa bhur |
| Ounla, [myrobalan seed.]..... | 2 ditto     |

Roast the alum and rub it well up with the sabzi in a little water, then with the other ingredients apply all round the eye for 3 or 4 days.

7. *Powder for ditto.*

|   |        |
|---|--------|
| Bhimseni Caphur, [purified camphor.]..... | 1 tola |
| Fine sugar.....                           | 1 tola |

Powder and sift very fine together, then take a feather and introduce a little into the eye for 4 or 5 days, when the eyes are very much swollen and inflamed.

8. *For accidental bruises, or swollen back or feet from long journeys, or hard work, or from exposure to cold or water.*

|                               |            |
|-------------------------------|------------|
| Nosadar, [sal ammoniac.]..... | 4 chittaks |
| Samar salt.....               | 8 ditto.   |
| Karwa tel.....                | 1 seer.    |

To be finely powdered, and beat up with the oil, and applied to the part affected, at the same time to be fomented with cow-dung fuel (uplah).

9. *Cathartic for an Elephant when she eats earth, or shows other symptoms of a foul stomach.*

|                                   |             |
|-----------------------------------|-------------|
| Musabbur Kamungai, [aloes?].....  | 12 chittaks |
| Chouk.....                        | 12 ditto    |
| Gandak balesnar, [sulphur.] ..... | 12 ditto    |
| Hing, [assafœtida.].....          | 12 ditto    |
| Old gur, [molasses.].....         | 1 seer.     |

To be made up into three balls, to be given at three different times. If however the elephant will not take this, give

No. 10. The roots of sarpat, 10 seers, to be made into an extract with water, make up 5 seers atta into cakes with  $\frac{1}{2}$  seer of salt, and the above extract : having baked the cakes, make the elephant eat them.—Should this be too violent, give

No. 11. Rice, 5 seers, boiled, to which add 4 chittaks of dahiye ; if not procurable, butter ; continue for a few days, after which the following cordial :

|  |            |
|--|------------|
| 12. Shrab, [wine.].....                      | 1 seer     |
| Katki.....                                   | 4 chittaks |
| Gol mirich, [black pepper.].....             | 4 ditto    |
| Anar ke chilka, [rind of the pomegranate.].. | 4 ditto    |

To be boiled in water and then mixed with the shrab, and the cakes to be broken up and mixed with these ingredients.

13. *A salve for an Elephant's back when nearly healed up.*

|                                 |             |
|---------------------------------|-------------|
| Bara nim, (leaves of the.) .... | 1 chittak   |
| Chotah nim, (do.).....          | 1 ditto     |
| Bylawe.....                     | 2 ditto     |
| Tutia, [blue vitriol.].....     | 1 pysa bhur |

To be filled into the wound, and a piece of rag stuffed gently in.

(To be continued.)

## XII.—Proceedings of Societies.

### 1.—ASIATIC SOCIETY—PHYSICAL CLASS.

*Wednesday Evening, the 4th April, 1832.*

The Honorable Sir Edward Ryan in the Chair.

1. Mr. Kyd presented some specimens of Barnacles of an unusual size, taken from a piece of timber found floating in the Bay of Bengal.

2. Mr. Calder presented, on the part of the *Société d'Histoire Naturelle de l'Île Maurice*, copies of the proceedings of that Society, and of the Annual Reports delivered at the Anniversary Meetings of the 29th August, 1830—1831.

There seems to have existed so far back as 1801, a *Society of Emulation at Port Louis*, Mauritius, instituted by Messrs. Bory de St. Vincent and Lislet Geoffroy, and several other naturalists who remained in the isle on the occasion of Gabarres expedition. From time to time it published articles on Natural History and other branches of knowledge—it held its last meeting to greet the arrival of Freycinet in the French ship of discovery, *L'Uranie*, in 1818.

Under the French government, Genl. Decaen had intended to add a cabinet of Natural History, with a library and collection of instruments, to the Lyceum founded by him, but the project was, from some unknown cause, frustrated. Long previous to the thought of such an institution, however, most of the natural productions of the isle had been brought to the knowledge of the world through the labours of Aublet, Commerson, Sonnerat, Jossigny, the Viscount de Kerhoens, so often quoted by Buffon, and even the celebrated St. Pierre, to whom may be added De Cosigny, Beauvais, and Céré.

In 1826, two naturalists resident at Port Louis, in the most disinterested manner offered to contribute their own collections towards the formation of a Museum connected with the College; but circumstances changed with English rulers, and no answer even was deigned by Sir G. Lowry Cole, or Genl. Darling.

The present Society owes its origin entirely to the private exertions of Mr. C. Telfair, Mr. J. Desjardins, and their friends.—They first thought of calling it “the *Asiatic Society*,” and connecting its labours with those of Calcutta and London, but preference was at length given to the present designation of “the *Natural History Society of the Mauritius*.” It opened its meetings on the 24th August 1829, the anniversary of the birth of the Baron Cuvier, the most distinguished natural philosopher of the present age; and the same auspicious day was fixed for the subsequent annual festivals of the Society. Two of these have since elapsed, and on each occasion an able and copious analysis of the past year's labours was read by the secretary Monsieur Desjardins. The present Governor Sir Charles Colville, at the earnest request of all the members, accepted the office of patron, and granted an apartment of the government house for the meetings of the Society. Reports of the proceedings of the Society will be published regularly in the Journal.

2. Read a letter from the Revd. R. Everest, addressed to the President, on the subject of the Indian sandstone, and describing the extraction of carbonate of soda and common salt from the soil in the neighbourhood of Ghazipur.

3. Read a note on the geology of Elephant Hill on the Quedah Coast, by Dr. Ward, Madras Medical Establishment, accompanied with specimens of the rock, communicated by Sir Charles Grey.

The country north of Quedah beach is an immense plain nearly level with the sea, and covered near the coast with mangrove, rising gently towards a small chain of hills to the east, 16 to 20 miles distant. The soil is a rich white



clay mixed with sand. From this plain, 6 miles inland, and quite insulated, rises abruptly the Elephant rock. The ground around it is a complete swamp, and the elephants in approaching were buried to the howdah in mud. The rock is a close grained limestone of a grey colour: it is penetrated by a number of caves of various dimensions: stalactites hang on the face of the rocks within and from the roof:—the floor is leveled by a stalagmitic incrustation, covering loose calcareous earth about 60 or 70 feet deep. In one of the caves, at an elevation of 8 or 10 feet above the surrounding plain, an insulated mass of shells was found; cockles, oysters, and a larger kind of muscle, connected together by calcareous matter: there was no appearance of shell strata in the rock.

The caves contain no sculpture. The natives assert that formerly the Elephant rock was surrounded by the sea.

4. A letter from Captain Grant, of Manipúr, communicated by G. Swinton, Esq. describing the process of extracting gold from the sand of the *Ningthee*; specimens of the gold dust and sand accompanied, and some crystallized pyrites. [This paper is inserted in the present number.]

5. Some account of the Lacquered or Japanned Ware of Ava, communicated by G. Swinton, Esq. on the part of Major H. Burney, Resident at Ava; illustrated by a complete series of specimens of the ware, as well as of the materials with which it is manufactured: also of the varnish and of the various metallic dyes used to colour it. [This will be published in our next.]

6. Description of a new species of *Buccros* or Nipál, the *Buccros Homrai*, by B. H. Hodgson, Esq., with remarks on its anatomical structure, by Dr. J. Bramley, and with an accurate drawing of the animal.

7. Account of the Salt Mines of the Panjáb, by Lieut. S. Burnes, Bombay Army, enclosed in a letter from that officer, dated *Rawil Pindi*, 10th March, 1832, with specimens of the native ore of lead, sulphur, alum, and red clay, from the range in which the salt is found. [Published in the present number.]

The thanks of the Society were voted for the contributions of the evening.

## 2.—MEDICAL AND PHYSICAL SOCIETY.

7th April, 1832.

J. C. Boswell, Esq. Assistant Surgeon, at Penang, was elected a Member of the Society. The following communications were presented to the Meeting:

1. An Essay on *Lepa Tuberculata*, as it appears in Bengal, by Dr. T. A. Wise.

2. Remarks on *Variola* and some *Varioloid* Diseases, which have recently occurred subsequently to Vaccination, by H. S. Mercer, Esq.

3. An additional communication on *Dracunculus*, with cases, by Dr. Mylne.

4. Proces verbal of the Proceedings of the Society of Natural History of the Mauritius, at the Meetings of 25th October and 23rd November, 1831, transmitted by Monsieur Desjardins.

5. A case of *Lithontrity* Instruments, with a copy of Mr. Atkinson's printed letter, addressed to the Medical Board of Calcutta, describing the process of *Lithontrity*. A letter from the Secretary of the Medical Board, states, that should cases of *Urinary Calculus* occur in the practice of any of the medical men at the Presidency, these instruments will be available for their use.

6. At the same time, Dr. Casanova brought for inspection of the Society, a complete set of instruments, made precisely after the model of those used by Mons. Civiale, at Paris; together with that author's work on *Lithontrity*. Mons. Civiale's apparatus is peculiar in the lightness and firmness of its construction, and in having a spiral spring to regulate the pressure of the borer against the stone;

during the action of the drill ; so that the aid of an assistant to the operator is not required. Dr. Casanova stated to the Society, that he has now a case of Urinary Calculus, under treatment by Civiale's process, and he exhibited some part of the stone which had been reduced to a powder by the first operation, on this subject. A chemical examination made by the President, proved this to be composed principally of carbonate of lime, with some phosphate of lime, and scarcely any lithic acid : a very slight trace of iron was apparent, probably from attrition of some particle of the Lithontritur. Dr. Casanova also presented to the Society, the fragments of a stone on which he had successfully operated at the Mauritius ; and he offered his apparatus, made after Civiale's model, for the use of any of the professional men at the Presidency, who might require it either for operation, or to have a similar apparatus made here.

7. A letter from Mr. Royle, on his departure from Calcutta, presenting for the Library six medical works, viz.

Dionis's Surgery.

Le Drian's Surgery.

Liquinius de Febribus.

Sennertus, Epitome Institut. Medicinæ, cum libro de Febribus.

Albertus Magnus de Morbis Mulier.

Michaeli's Scotus, Opusculum de Secretis Naturæ.

The following papers were then read and discussed by the Meeting :

The case of disease of the heart formerly presented by the Medical Board.

Dr. Casanova's case of Elephantiasis.

Mr. Mercer on Small-pox after vaccination.

This paper commences with a few remarks on the occasional occurrence of small-pox oftener than once in the same person ; the author then observes, that although the greatest benefits have been derived from vaccination, (the efficacy of which generally as a preventive of variola he fully acknowledges,) still it must be allowed, that sometimes a modified small-pox occurs after vaccination ; and in few very rare instances, the severer forms of confluent small-pox happen. Several cases of variolous and varioloid disease have recently fallen under the author's observation, the particulars of which he now placed before the Society ; from consideration of these cases, he concludes, that the varioloid disease, after vaccination, occurs in a great variety of forms, and with considerable diversity in its eruptive symptoms, as well as in the degree of intensity of the attendant pyrexia. He is also inclined to believe, that some individuals who have been for a time protected against variola by vaccination, may become afterwards liable to suffer from the former disease ; although the present cases would not support a conclusion that there was any particular period at which the prophylactic property of vaccination ceased ; as the patients he has lately treated, while suffering from varioloid diseases, were aged respectively, 29, 28, 22, 20, 19, 13, and seven years ; they were vaccinated in infancy, and there is no evidence that any of them had in the interval been exposed to variolous contagion.

Mr. Hutchinson on the Proximate Cause of Cholera.

Mr. Hutchinson attempts to explain the mode in which the phenomena of that disease are produced. The idea of its depending on inflammation in the intestinal canal, (even were it shewn that an affection of that nature is invariably present, in the early stage of the disease, which it is not,) he considers totally inadequate to account for the phenomena. Mr. H. conceives Cholera to depend on a certain state of disorder of the functions of respiration, whereby the changes

essential to life, effected in that process, are influenced; perhaps principally the consumption of oxygen and evolution of carbonic acid gas. This state of disorder, Mr. H. considers to be the consequence of certain noxious changes, either in the electrical or gaseous constitution of the atmosphere; (most probably, by the former remotely, and the latter more directly;) by which the delicate nervous tissue of the lungs becomes impaired in its energies, and oxygen ceases to be consumed in the quantities essential to life.

### 3.—NATURAL HISTORY SOCIETY OF THE MAURITIUS.

*Tuesday, 20th July, 1831.*

M. Delisse, sen. communicated a letter received by him from M. Cailand, *Conservateur-adjoint* of the Museum of Natural History at Nantes, in which he proposed to effect a mutual exchange of objects with such of the members as might desire it.

The President read a letter from Sir Alexander Johnstone, to his excellency the Governor Sir Ch. Colville, dated London, 26th Feb. begging him to apprise the Society that H. R. H. the Duke of Sussex, now Pres. of the Royal Society of London, would extend his patronage to all scientific or literary Societies which might be formed at the Mauritius. The same letter mentioned the favorable reception of Professor Dabacé's observations on the comet of 1830, both by the Royal and by the Royal Asiatic Society, of which he had been elected an honorary member.

The Secretary was directed to acknowledge the honor of H. E.'s communication.

Mr. L. Bouton read an extract of a letter from Mr. Ad. Brongniart, inviting the aid of the Society in aiding the objects of the new school of arts and manufactures of Paris (where a new course of studies is recently opened,) by forwarding specimens of all substances employed in the domestic arts and manufactures of the island.

Mr. Lienard, sen. having proposed to write to the Governor, praying his support of the classes of physic, chemistry, and natural history, which had lately taken the place of the Botanical lectures at the Royal College,—Mr. Delisse, sen. read a work he had drawn up on the subject, which met with approbation from all the members present, and he was requested to undertake the drafting of the present address.

Mr. Bojer gave verbally the description of two birds of Agaléga, (male and female,) which he took to be the Ibis of the ancients: the specimens were from M. Delisse's collection.

The number of objects presented at this meeting was considerable.

A tiger skin, 12 feet long,—*by M. Wéké.*

A mummified head from New Zealand, of the chief Mallowolla, sent from Sydney by Captain Foreman,—*by Mr. C. Telfair.*

The rib of a woman which fell to his share in a feast among the cannibals of the same place,—*by Captain Briggs.*

• Mr. Briggs saved and brought away a child of 7 or 8 years old, which was about to be sacrificed; its features are those of the Malgaches, or Creoles of the Isle of France.

The skins of two Maki, also some minerals and insects, with descriptions,—*by Mr. Cameron.*

Capt. Briggs, Mr. R. Campbell of Sydney, and Mr. S. Lair, of Paris, were elected honorary members.

XI.—*Catalogue of Mammalia observed in the Dakhan.* By Major W. H. Sykes.

[Reprinted from the Proceedings of the Zoological Society of London.]

*Homo sapiens*, L.—The people inhabiting the Dakhan have the Georgian form of skull; their stature is low; the colour of the skin brown, with shades running into yellow white in the higher classes, and black in the lower. The females are not distinguished for fertility, the average number of births to a marriage being less than in Europe. More males are born than females, and in nearly four millions of people I found the proportions of females to males to range in different districts from eighty to ninety females to one hundred males.

*Semnopithecus Entellus*, F. Cuv. *Makar* of the Mahrattas.—This species is found in large troops in the woods of the Western Ghats. It is not venerated by the Mahratta people, nor do they object to its being killed.

SEMN.? ALBOLUTARIS, Sykes. *Semn.?* *suprà flavo nigroque, infrà albo nigroque, irrortatus*; *gula n. d.*; *artabus nigris*; *masticibus latis aureis penè obvelantibus*; *superiorum pilis rigidis exstantibus.*

*Hab.* in Madagascar?

This species (a living individual of which is now in the garden of the Society) appears to be new to science. It is only provisionally classed as a *Semnopithecus*, pending our inability to examine its posterior molars. The animal was obtained at Bombay, where it was believed to have been taken from Madagascar; and as it has some characters in common with the *Cercopithecus* (especially with the group of which the *Cerc. Sabaeus* forms a part) and the *Semnopithecus* of India, it may ultimately prove to be a connecting link between the African and Asiatic monkeys. It wants the long limbs of the *Semnopithecus*; and although its tail is very long, it is not particularly thin.

The following is the description of the animal—a male. Canines remarkably long (nearly  $\frac{1}{2}$  of an inch), slender, sharp; incisors very short and even. Head rounded and short. Ears very small, nearly rounded, and for the most part concealed in the long hair about the head. Eyes deeply seated, and shaded by a continuous arch of long hairs directed forwards. *Irides* broad; of a brown ochre colour: hair forming a bunch on each cheek and resembling whiskers: no beard. Cheek pouches rudimentary only, not observable externally, even when filled, being concealed by the bushy hair of the cheeks. Thumbs of anterior hands short and distant; those of the posterior long. Whole of the upper surface of the animal of a mingled black and yellowish ochre colour, each hair being banded black and ochre; the black prevailing on the shoulders, the ochre on the back and flanks. Under surface grizzled white and black. Anterior limbs uniform black; posterior black, with a little of the dorsal colour. Chin and throat pure white. Tail black, half as long again as the body.

The manners of this monkey are grave and sedate. Its disposition is gentle but not affectionate: free from that capricious petulance and mischievous irascibility characteristic of so many of the African species, but yet resenting being teased, and evincing its resentment by very smart blows with its anterior hands. It never bit any person on board ship, but so seriously lacerated three monkeys, its fellow passengers, that two of them died from the wounds. It readily ate meat, and from choice would pick a bone even when plentifully supplied with vegetables and dried fruits.

*Macacus radiatus*, Geoff. *Wahnar* of the Mahrattas.—This well known species inhabits the woods of the Western Ghats in small troops. A female brought to England by me and presented to the Society, was capricious and mischievous in disposition, but of surprising courage and marked intelligence. It manifested considerable attachment to myself, which was less transient than I had anticipated, as it greeted me with evident demonstrations of joy on my visiting it in the gardens after the lapse of a month without seeing me. The natives of Western India educate this monkey to perform certain tricks.

*Pteropus medius*, Temm. *Warbagul* of the Mahrattas.—This species is very numerous in Western India. Such variations are found in the colouring of different individuals in the same troop, that two or three species might be supposed to exist in it; but the great mass so closely resembles the *Pter. medius* of M. Temminck, that I do not consider myself justified in describing the *Rosette* of the Dakhan as a distinct species. The only persons in Western India who eat these *bats* are the native Portuguese, but I can personally testify that their flesh is delicate and

without any disagreeable flavour. I have measured individuals with a greater length of body ( $14\frac{1}{2}$  inches) than is given to the *Pter. Javanicus* of Dr. Horsfield.

*Nyctinomus plicatus*, Geoff. (*Vespertilio plicatus*, Hamilton?)

This bat bears a very close resemblance to Dr. Horsfield's *Nyct. tenuis*.

**RHINOLOPHUS DUKHUNENSIS**, Sykes.—*Rhin. suprà murinus, infrà albido brunneus; auribus capite longioribus: antibrachio corpus longitudine æquante.*

This bat belongs to the same section as Dr. Horsfield's *Rhin. insignis*, but differs from that species in being much smaller; in having the ears larger and more rounded; the nose-leaf with the upper lobe concave, ridged beneath and revolute above; and the front lobe oblong and notched in the centre. It differs from the *Rhin. crumeniferus*, Pér. and Le Suenr, (which is the *Rhin. marsupialis* of M. Geoffroy's lectures, and the *Rhin. Speoris* of M. Desmarest,) in being much smaller, this species having the fore arm nearly half as long again as the Dakhan bat. The upper nose-leaf also is much more produced, and finally the colour of the fur in this species is reddish. The fore arm of the *Rhin. Speoris* as figured, is 2 inches 2 lines long, and the body and head 2 inches 2 lines. In the Dakhan species the fore arm is only the length of the body. Expansion of its wings 10 inches.

**Sorex Indicus**, Geoff. *Cheechontur* of the Mahrattas.—These troublesome and disagreeable animals are very numerous in the Dakhan, but much more so in Bombay. They do considerable damage in cellars by tainting the wine; and the passage of an individual over a vessel of water impregnates the whole mass with the scent of musk. I have had occasion to remark that the sebaceous glands in an old male were very large, and the odour of musk from them almost insupportable; while in an adult female the glands have been scarcely discoverable, and the scent of musk very faint. The Indian Shrew is as much carnivorous as insectivorous. Having killed the *Sorex Indicus* and *Sor. giganteus*, in the same room, and seen them frequently together, I look upon them as of the same species.

**Trans labiatus**, Blainv. *Aswat* of the Mahrattas.—The system of dentition of this well-known animal appears to be anomalous; for instead of six incisors in each jaw, I have never seen more than four in the upper and six in the lower; the two centre teeth standing a little in front of the line of the rest. I have had opportunities of examining many skulls of animals of very different ages, and possess specimens at the present moment, all of which agree in the number and position of the incisor teeth. One of these individuals is so young that I do not conceive that the deficient incisors can have fallen out; nor is there any appearance of dentition having existed in the places which they should have occupied. It might be deemed advisable therefore to remove this animal from the genus *Ussus*.

An *Aswat* brought to me from the woods when quite young, and which lived some time in my possession, fed by choice almost exclusively upon roast mutton and fowl; rejecting all fruits and vegetables. It ate, however, steeped grain (*Cicer arietinum*), and was very fond of buttermilk. These animals when taken young are readily instructed.

**Lutra Nair**, F. Cuv. *Jahl Mārjar* or *Water Cat* of the Mahrattas.—The *Otter* of Dakhan differs only from the *Nair* in wanting the white spots over the eyes, in having a white upper lip, and in being somewhat larger; discrepancies which do not justify its being separated as a species.

**CANIS DAKHANENSIS**, Sykes.—*Kulan* of the Mahrattas.

*Can. rufus, subtus pallidior: caudā comasā pendente: pupilla rotundatā.*

This is the *Wild Dog* of the Dakhan, and differs from any wild species hitherto described. Its head is compressed and elongated; its nose, not very sharp. The eyes are oblique: the pupils round, irides light brown. The expression of the countenance that of a coarse ill-natured *Persian Greyhound*, without any resemblance to the *Jackal*, the *Fox*, or the *Wolf*, and in consequence essentially distinct from the *Canis Quao* or *Sumatrensis* of General Hardwicke. Ears long, erect, somewhat rounded at the top, without any replication of the *tragus*. Limbs remarkably large and strong in relation to the bulk of the animal; its size being intermediate between the *Wolf* and *Jackal*. Neck long. Body elongated. Between the eyes and nose, red brown: end of the tail blackish.

From the tip of the nose to the insertion of the tail, 33 inches in length: tail  $8\frac{1}{2}$  inches. Height of the shoulders  $16\frac{1}{2}$  inches.

These animals hunt in packs, and the specimen brought to me was found to have the stomach distended with the remains of a *nylgau*.

None of the domesticated Dogs of the Dakhan are common to Europe.

The first in strength and size is the *Brinjari Dog*, somewhat resembling the *Persian Greyhound*, in possession of the Society, but much more powerful. It is employed by the erratic people, the Brinjaris, in protecting their herds and in hunting. Its strength enables it to pull down the largest animals of the chase. It is courageous and intelligent.

The *Pariah Dog* is referable to M. Cuvier's second section. These animals are very numerous; they are not individual property, and breed in the towns and villages unmolested. Many of these dogs hunt very well by scent.

Amongst the Pariahs is frequently found the *Turnspit Dog*, long backed, with short crooked legs.

There is also a petted minute variety of the *Pariah Dog*, usually of a white colour and with long silky hair, corresponding to a common *Top-Dog* of Europe; this is taught to carry flambeaux and lanterns.

The last variety noticed is the *Dog* with hair so short as to appear naked like the *Canis Egyptianus*. It is known to Europeans by the name of the *Polygar Dog*. CANIS PALLIUS, Sykes.—*Landgah* of the Mahrattas.

*Can. sordide rufescenti albidus; dorso nigrescenti ferrugineoque vario; pedibus totis pallide ferrugineis; caudæ sublongæ pendente.*

This is the *Wolf* of the Dakhan. Its head is elongated, and its muzzle acuminated; a groove exists between the nostrils. Eyes oblique; *irides* yellowish bright brown. Ears narrow, ovate, erect; small for the length of the head. Tail pendulous, thin but bushy, extending below the *os calcis*. General colour of the fur a dirty reddish white or whitened brown. Along the back and tail very many of the hairs are tipped black, mixed with others tipped ferruginous. The tail ends in a black tip. The inner surface of the limbs, the throat, breast, and belly, dirty white; legs pale. From the ears to the eyes reddish grey, with a great number of short black hairs intermixed; from the eyes to the nostrils, light ferruginous. The fur from the occiput to the insertion of the tail is two or three inches long, gradually shortening as it approaches the sides; hence all over the body very short and lying close.

The description is taken from two three-parts grown animals, which I had alive for a considerable time in my possession.

Length from tip of nose to insertion of tail 35 to 37 inches; of the tail 11 to 12 inches; the hair extending two inches beyond the measurement.

These animals are numerous in the open stony plains of the Dakhan; but are not met with in the woods of the Ghats.

*Canis aureus*, Linn. *Kholah* of the Mahrattas.—The *Jackal* of Dakhan appears to be identical with the *Lavantu* and *Persian Jackal*. They are numerous in the Dakhan, and are terrible depredators in the vineyards. They are easily domesticated when taken young. I had a very large wild male and a domesticated female in my possession at the same time. The odour of the wild animal was almost unbearable. That of the domesticated *Jackal* was scarcely perceptible.

CANIS KOKRI, Sykes.—*Kokri* of the Mahrattas.

*Can. supra rufescenti-griseus, infra sordide albus; caudæ comosæ apice nigro; pedibus rufescentibus; pupillâ elongatâ.*

The *Fox* of the Dakhan appears to be new to science, although it much resembles the descriptions of the *Corsac*. It is a very pretty animal, but much smaller than the *European Fox*. Head short; muzzle very sharp. Eyes oblique; *irides* nut-brown. Legs very slender. Tail trailing on the ground; very bushy. Along the back and on the forehead fawn-colour, with hair having a white ring near to its tip. Back, neck, between the eyes, along the sides and half way down the tail reddish grey, each hair being banded black and reddish white. All the legs reddish outside, reddish white inside.

Chin and throat dirty white. Along the belly reddish white. Ears externally, dark brown, and with the fur so short as to be scarcely discoverable. Edges of eyelids black. Muzzle red-brown.

Length 22 and 22½ inches: of the tail 11½ to 12 inches.

*Viverra Indica*, Geoff. (*Viv. Rasse*, Horsf.) *Jawâd Mârjar*, or *Civet Cat* of the Mahrattas.—There are two varieties of this species of *Viverra* in the Dakhan; one inhabiting the woods along the Ghats; the other the country eastward of the Ghats. The animal of the Ghats exactly resembles a specimen now in the

Museum, and formerly in the Menagerie of the Society; the ground colour being much grayer, and the lines more distinctly broken into spots. The other variety resembles in its ferruginous tint the specimens of the *Rasse* presented to the Society by Major-General Hardwicke, but has the four black longitudinal lines or stripes on the sides of the neck more marked, and is considerably larger: two of my specimens from the Dakhan being 27½ and 28½ inches long.

The Dakhan variety exhales a very powerful odour of musk, and the organs for the secretion of this dung are of considerable size.

The specimen presented by me to the Society died on board ship; and some hundreds of capillary worms were found all over the body lying between the skin and the flesh.

*Herpestes griseus*, Desm. *Mangús* of the Mahrattas.—The *Mangús* of Dakhan is no doubt the *Herp. griseus* of M. Desmarest, but very considerably exceeds in size the published measurements of that species; my specimens measuring from 19½ to 20½ inches from the tip of the nose to the insertion of the tail, and the tail 15 to 16½ inches. This animal is decidedly plantigrade. In movement it appears to slide along the ground, rather than trot or canter. It is believed by the Mahratta people to have a natural antipathy to serpents, and in its contests with them to be able to neutralize the poison from the bite of the serpent, by eating the root of a plant called *Mangús-wail*; but no one has ever seen the plant. Probably they allude to the *Ophorhiza*, *Mungos*.

*Paradoxurus Typus*, F. Cuv. *Ud* of the Mahrattas.—This animal, which is by no means rare in the Dakhan, is always lively, and a specimen in my possession was remarkable for the energy with which during the night time it chased round its cage. Its carnivorous propensities were so strong that it snapped off and devoured the heads of all fowls that incautiously approached its cage; but on board ship it was fed entirely on rice and clarified butter. In the stomachs of some individuals examined at Poona, I found fruit, vegetables, and *Bluttee*.

*Hyæna vulgaris*, Cuv. *Tarras* of the Mahrattas—*Hænas* are numerous in Dakhan. They are susceptible of the same domestication as a dog. The animal given by me to the Society was allowed to run about my house at Poona; and on board ship it was in the habit of gamboing like a dog. It allowed persons to put their hands into its mouth without attempting to bite ill-naturedly. It was fed on rice and clarified butter.

*Felis Tigris*, L. *Pattite Wagh* or *Striped Tiger* of the Mahrattas.—Royal tigers are so numerous in the province of Khandesh, that 1032 were killed from the years 1825 to 1829 inclusive, as appears by the official returns handed to me. They are much less numerous in the collectorates of Poona, Ahmednagar, and Dharwar.

*Fel. Leopardus*, *Chlta* of the Mahrattas.—This would appear to be the *Leopard* of Mr. Temminck's monograph of the genus *Felis*. It is a taller, longer, and slighter built animal than the succeeding, which I consider the *Panther*. It differs also in more of the ground colour being seen, and in the rose spots being much more broken: there are also other specific differences which the nature of this catalogue does not admit of my entering into. The natives of Dakhan consider the *Chlta* and succeeding Cat as distinct animals. The *Chlta* is rare. The *Panther* very abundant. I do not possess a specimen of the *Leopard*; the only one I was enabled to obtain having been given by me to the East India Company.

*Fel. Pardus*, *Bibba Bagh* of the Mahrattas.—This species is so abundant that 472 were killed from 1825 to 1829 inclusive, in the four collectorates of Dakhan. It exactly resembles the animal figured as the *Panther of the ancients* in Mr. Giffith's 'Translation of the *Régne Animal*.' It differs from the preceding in its smaller size, stouter make, darker ground colour, and in its crowded rose rings. The Society is in possession of several of these Cats; amongst others a half-grown animal from the Dakhan, which I presented to it in December last.

*Fel. Jubata*, L., and *Fel. venatica*, H. Smith. *Chlta* of the Mahrattas.—These presumed species appear to me to be identical, the specific differences deduced from the hair originating in domestication. I have a skin of the wild animal with a rough coat, in which the mane is marked, while domesticated animals from the same part of the country are destitute of a mane and have a smooth coat. They are led about like greyhounds; but when carried out to hunt are placed upon a cart.

*Fel. Chaus*, Guld. *Mota Rahn Manjur*, or *Larger Wild Cat* of the Mahrattas.—This species has a very extended geographical range, being found in Egypt, on the Caspian, in Persia, at Bangalore, and in the Dakhan. It frequents bushy moist situations. The only addition I can give to the published descriptions of it, is that the *irides* are of a bright reddish light yellow.

*Fel. torquatus*, F. Cuv. *Lhan Rahn Manjur*, or *Lesser Wild Cat* of the Mahrattas.—This animal is a pest, from the damage it does in poultry-yards in the Dakhan. It inhabits the grass roofs of houses, and thick hedges, and obscure places of our cantonments, shunning the face of man and the light, but is constantly on the alert at night. My specimens differ only from the *Fel. torquatus* figured in the third volume of the *Histoire Naturelle des Mammifères*, in the ears externally being tipped dark-brown, and in having two narrow stripes behind the eyes instead of one. The sexes resemble each other in colour, marks, and size.

*Mus giganteus*, Hardw. *Ghla* of the Mahrattas.—This is the well-known *Bandikhat Rat*. In fully grown individuals, none of the teeth are tuberculous. Two specimens in my possession exceed in size any yet described, measuring respectively  $16\frac{1}{2}$  inches, and  $14\frac{5}{8}$  inches on the body. Tail  $11\frac{5}{8}$ , and  $11\frac{1}{8}$  inches.

Unlike the common *Rat*, these animals seem to be entirely granivorous. They burrow under walls, and make such considerable excavations as to injure the foundations of buildings.

*Mus decumanus*, Pall. *Chla* of the Mahrattas.—This species, the well known *Norway or Brown Rat*, abounds in Dakhan. It has been seen to migrate in thousands, destroying the crops in its march.

*Mus Musculus*, L.—This mouse is comparatively rare in the Dakhan.

*Mus* ———. Bright light chestnut above, reddish white below. Tail much longer than the body : size of the common mouse. Found only in fields and gardens. I believe this species to be new, but until I can recover the specimens which I brought to England, I refrain from naming it.

*SCIURUS ELPHINSTONII*, Sykes.—*Shekrá* of the Mahrattas.

*Sc. supra nitide castaneus, infra rufescenti-albidus; caudæ dimidio apicali pallide rufescente.*

This very beautiful animal is found only in the lofty and dense woods of the Western Ghats, and has rarely been seen by Europeans in the Dakhan. It is of the size of the *Sc. maximus*, and the general arrangement of its colours is the same ; and as the *Sc. maximus* passes through some gradations of colour, the *Sc. Elphinstonii* might be supposed by casual observers to be a variety of that species. I am enabled to state, however, from personal observation, that the latter does not change its colour at any period of its life ; specimens being in my possession of the most tender and mature ages.

Ears and whole upper surface of the body, half way down the tail, outside of the hind legs and half way down the fore legs outside, of a uniform, rich reddish chestnut. The whole under surface of the body, from the chin to the vent, inside of limbs, and lower part of fore legs, crown of the head, cheeks and lower half of tail, of a fine reddish white, the two colours being separated by a defined line and not merging into each other. Feet of a light red. Forehead and down to the nose reddish brown, with white hairs intermixed. *Irides* nut-brown. Ears tufted. Length of a male in my possession from the tip of the nose to the insertion of the tail 20 inches. Length of tail 15½ inches.

The cry of this animal is *Chák, chák, chák*; at first uttered slowly and then rapidly, and it is so loud as to have a startling effect.

I have dedicated this *Squirrel* to a very distinguished person and a zealous promoter of scientific research, the Hon. Mountstuart Elphinstone.

*Sc. Palmarum*, Briss. *Kharri* of the Mahrattas.—This well-known *Squirrel* is so abundant in gardens in the Dakhan that I have repeatedly caught two or three at once by simply planting out under a tree, a common wire rat-trap, baited with a little flour. Nothing can be more light and elegant than the movements of these little creatures. I have witnessed some singular instances of affection for their young in this species, which my limits do not permit me to detail.

*HYSTRIX LEUCURUS*, Sykes.—*Sagal* of the Mahrattas.

*Hyst. caudá albá.*

This animal appears to be distinct from the European species, which it closely resembles in form and covering. It is nearly a third larger. All the spines and tubes of the tail are entirely white, which is not the case in the *Hyst. cristata*. The



spines of the crest also are so long as to reach to the insertion of the tail. The ears are much less rounded, and the nails are shorter, infinitely deeper and more compressed, and with deep channels below. The white gular band is more marked; and, finally, the Asiatic species is totally destitute of hair, spines where wanting being replaced by strong bristles even down to the nails.

This species is abundant in the Dakhan and is very good eating. Like the African *Porcupine*, when alarmed or irritated it shakes the tubes and spines of its tail violently, producing a startling noise. It stamps also with great energy with its hind feet; and when it assails an adversary it runs obliquely backwards, transfixing the foe with its spines.

*Lepus nigricolis*, F. Cuv. *Sassah* of the Mahrattas.—This species of *Hare* is so common in the stony and bushy hills of the Dakhan that I have had nearly a dozen brought to me, in the course of a few hours, by two or three men using nets called waggurs.

*Manis crassicaudata*, Griff. *Kuelli Manjur*, or *Tiled Cut* of the Mahrattas.—This species is very common in the Dakhan. They are incapable of climbing trees, and invariably move with the foreclaws doubled under the feet, so that they appear to walk on their knuckles. They live on white ants, and lap water like a dog; and like a dog also they are infested by the large blue tick. Their only defence is in coiling themselves up, and so strong is the muscular power of the tail, that I have had two men attempt in vain to unroll an animal.

*Sus Scrofa*, L. *Dikar* of the Mahrattas.—*Wild Hogs* abound in the Dakhan, and the males attain to a very great size. I am not satisfied that there is any specific difference between the European and Asiatic *Wild Hog*. Every village abounds with *Hogs*, but any property in them is equally abjured by individuals and the community. They live in the streets, are the public scavengers, and dispute with the *Pariah Dog*, the possession of offal matters thrown out from the houses. They are certainly of the same species as the *Wild Hog*. The flesh of the latter is eaten by almost all castes of Hindûs excepting the Brahmins and Banias; but the flesh of the village *Hog* is not even touched by the carrion-devouring outcasts the *Mahr*. The village *Hog* is of the same colour as the wild animal, mostly a rusty black, and the only variations are slate black or slate intense brown; but it is not above two-thirds of the size of the latter. Tail never curled or spirally twisted.

*Equus Caballus*, L. *Ghora* of the Mahrattas.—A fine breed of *Horses* exists on the banks of the Bina and Mann rivers in the Dakhan, supposed to have been improved by the Arabian blood. I have been assured by a Brahmin that as much as 10,000 rupees (1,000*l.*) has been paid by a native chief for an animal of this breed.

The variety of the Horse called *Pony* by us, and *Tattoo* by the Mahrattas, is sedulously propagated in the Dakhan, on account of its great use in the transport of baggage. The *Tattoo* is remarkable for its vicious propensities.

*Equus Asinus*, L. *Gadha* of the Mahrattas.—The *Ass* of the Dakhan is very little larger than a good mastiff or Newfoundland dog, but I have not remarked any other difference between it and the ass of England. Wild asses do not exist there, but they are said to be found in Katiwar.

*Camelus Dromedarius*, L. *Unt* of the Mahrattas.—The *Dromedary* is rarely bred in the Dakhan, but is in very general use; indeed armies in India could scarcely move without its aid. The two-humped *Camel* is not known.

*Moschus Moschiferus*, Erxl. *Pisorch* of the Mahrattas.—This beautiful little animal is found in considerable numbers in the dense woods of the Western Ghats, but never on the plains. It readily reconciles itself to confinement, and a friend of mine had a pair that bred yearly. Its *irides* are of a deep brown. The flesh is excellent eating.

*Caracus equinus*, Cuv. *Sambur* of the Mahrattas.—This animal, which abounds in the Ghats of the Dakhan and in Khandesh, is no doubt the same as the Malayan *Rusa* figured in Griffith's 'Translation of the R gne Animal.' It wants the size of the *Cerv. Aristotelis* of Bengal, also called *Sambur* (not *Sambu*), and is not so dark in colour.

*Cerv. Muntjak*, Zimm. *Baiker* of the Mahrattas.—This beautiful species of *Deer* is a native of the Western Ghats of the Dakhan, and is never seen on the plains. An examination of the animal now in the Society's gardens will afford satisfactory evidence that those who have hitherto figured the animal, in works on Natural History, have been unhappy is not representing its true character. It always runs with

its head down and back arched. It is supplied with large suborbital sinuses, which it uses in the manner of the *Ant. Cervicapra*.

*Antelope Cervicapra*, Pall. *Bahmani* Horn of the Mahrattas.—This animal abounds on the plains of the Dakhan in flocks of scores, but is not met with in the Ghats. The suborbital sinuses are capable of great dilatation, and the animal applies them to objects as if for the purpose of smelling.

ANT. BENNETTII, Sykes. *Ant. cornutus nigris, lyratis, apicibus levibus leviter intorsum antorsumque cecis, ad basin ultra medium annulatis (annulis 8-9); rufescenti-brunneus, infra albus, jascuâ laterali hinc conspicuâ; jascuâ mediâ strigulâ ob angulo oculi ad oris angulum extensâ nigris; c. rudâ m. p. a.*

*Kalsip* or *Black Tail* of the Mahrattas. Goat *Antelope* of Europeans.

This *Antelope* is found on the rocky hills of the Dakhan, rarely exceeding three or four in a group, and very frequently solitary. It belongs to the same section as the *Ant. Dorcas*. Horns erect, slightly diverging from each other, bending slightly backwards, at first subsequently with their joints bending forward. Ringed for  $\frac{2}{3}$  of their length. The whole upper surface and outside of the limbs rufous or red brown. Under surface and inside of the limbs white. Tail black. A black patch on the nose. A black narrow streak from the anterior corner of each eye towards the angle of the mouth. Suborbital sinuses very small; in dried skins not observable; nor does the animal dilate them unless very much alarmed. Limbs long and slender; black tufts at the knees. Body light. The female has horns, but they are slender, cylindrical, and without rings. The buttocks present a heart shaped patch of white. Unlike the *Ant. Cervicapra* it carries its tail erect when in rapid motion. It stands as high as the *Bahmani* Horn, but has less bulk.

*Ant. ———*. Brown *Antelope*.

I possess the skin of a three-parts grown *Antelope*, a native of the Dakhan, which lived for some months in my possession, but which its immature age prevents me from identifying. It had much the air of the *Ant. rufescens* and *Ant. silvicultrix*. It promised to have been a stouter animal than the *Ant. Bennettii*. Its habits were quite different, and it was remarkable for the impunity with which it fed, like a goat, upon the poisonous *Euphorbia Tirucalli*. The whole animal was brown above, whitened brown below. Horns cylindrical, pointed, without rings.

*Capra, Hircus*, Linn. *Baki* of the Mahrattas.

The goats in the Dakhan are gaunt, stand high on their legs, have the sides much compressed, and are covered with long shaggy hair, which in most is black. Ears nearly pendent. *Irules* ochrey yellow or reddish yellow. Tail always carried erect in movement.

*Ovis Aries*, Linn.—*Sheep* are most extensively bred in the Dakhan, and as many as 20,000 or 30,000 sheep and goats may be seen together in the uncultivated tracts. The Dakhan variety has short legs, short thickish body, and arched chaffron. The wool is short, crisp, and coarse, and in nine out of ten sheep is black. Coarse blankets only are made of the wool. In most sheep there is a white streak or line from the anterior angle of each eye towards the mouth, and a white patch on the crown of the head. Away from our cantonments sheep are bought at 2s. per head.

*Ant. picta*, Pall. *Damalis risca*, H. Saute. *Rai* of the Mahrattas. *Nylgâu* of the Persians.

This animal is an inhabitant of the Western Ghats of the Dakhan. The female is of a much redder slate hue than the male, and the young are absolutely rufous, changing and deepening to gray-slate with age.

*Bos Taurus*, var. *Indicus*. (*Bos Indicus*, Linn.) *Pohl* and *Byl* of the Mahrattas.

This animal, remarkable for its hump, is when early training to labour or to carriage nearly destitute of it. The *Brahmani Bull*, of which the Society has a fine specimen, in its free state, is scarcely able to move from obesity; but employed in the yoke or in carrying loads it would hardly be recognized as belonging to the same race. Park cattle are most extensively bred by the singular erratic people, the Brnjaris, and an army rarely moves in the field without 15,000 or 20,000 bullocks to carry its grain. Dwarf cattle are not met with in the Dakhan.

*Bos Bubalus*, Br. Male called *Tondgah*; Female, *Mahs* of the Mahrattas.

The *Buffaloe* of the Dakhan, which is the long-horned variety, is mostly bred in the Mavals or hilly tracts along the Ghats. In those tracts much rice is planted, and the male *Buffaloe* from his superior hardihood is much better suited to resist the effects of the heavy rains, and the splashy cultivation of rice than the bullock. The female is also infinitely more valuable than the cow, from the very much greater quantity of milk she yields.



# JOURNAL .

OF

## THE ASIATIC SOCIETY.

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*No. 5.—May, 1832.*

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I.—*Some Account of the Lacquered or Japanned Ware of Ava.*  
*By Major H. Burney, Resident at the Burmese Court.*

[Read at the meeting of the Phys. Cl. 4th March.]

This manufacture has been named lacquered ware from an idea, I suppose, that lac forms a part of it; but this is a mistake: no lac is used, and the bright red colour is given by vermilion, which is made by the Burmese from Cinnabar (*a yain*), imported by the Chinese caravans from Yunnan.

The principal material is known to be the Burmese varnish, or *theet-tsee*, which means literally “wood oil.” There must be a great abundance of it in the country, as the usual price at the capital is only  $\frac{3}{4}$  of a *tical* per *viss*, or about 5 pence per lb.; but it is often much adulterated, and requires to be strained through a piece of cloth before being used. There are three descriptions of it at Ava. The first and purest is called *theet-tsee-ayoung-den*, from *ayoung* colour, forming of itself a beautiful black colour. The second is called *theet-tsee-anee-hyan*, from *anee* red, being that commonly used with vermilion or red colour. This is said to have one-quarter of water mixed with it. The third and worst description is called *theet-tsee tha-yo-byau*, from *tha-yo*, a paste, which will hereafter be described; and to make which, this *theet-tsee* is generally used. This last kind has no less than one-half of water mixed with it, and there is said to be no difficulty in making water combine with the *theet-tsee*, by rubbing the two well together in the sun. The price of the best *theet-tsee* is just now at Ava 7 *ticals* for 10 *viss*.

The Burmese workmen declare, that the varnish will not *ait*, sleep or lie, or dry well, if collected from the tree when it is in fructification : which, they say, occurs during the three months of January, February, and March. Nor will the lacquered ware, during the process of manufacture, become soon and properly *ma*, or hard, in the dry hot months before the rains set in, or at any time so well, as when it is lodged, as Dr. Wallich understood, “ in dark and cool subterraneous vaults.” The varnish is placed in the sun for a few minutes before it is used, and being almost always applied with the hand, the smallest grain of sand or other extraneous substance is immediately detected and removed. When first applied, it looks of a light-brown colour, but as the hand is rubbing on the varnish, it becomes darker, until it attains a beautiful black colour. Sometimes, when the frame work is of wood, a piece of tow is used for rubbing the *theet-tsee* on, and generally, to save the hand, the first coat is applied with a rude brush made of the husk of the cocoa-nut. After using the varnish, the hand is cleaned with a little mustard-seed oil, and coarse cloth or tow. Upon asking the workmen if they do not suffer any bad effects from the varnish, as I recollect reading of some one at Edinburgh having suffered severely, they admitted that they often, and particularly when they first begin to work in it, find their hands blister and their arms and faces swell, but that some people are much more pre-disposed to suffer in this manner than others. Hence, they have a kind of proverb, *theet-tsee thek-sè thee* “ varnish is a witness ;” *loo-ma-then phyet-thee*, “ it affects a man not true ;” *loo-then atzama-shee*, “ to a true man it matters not.” About one in a hundred is said to be so pre-disposed. Some of the workmen told me, that they always use their left hands in taking their food, and that sometimes the deleterious effects of the varnish appear in blotches so much resembling leprosy, that other Burmese refuse to hold intercourse with workmen so affected. These effects however are removed by applying to the affected parts a lotion made of teak-wood rubbed on a stone with a little water. Sometimes sandal-wood as well as teak is used, but the latter is considered as the real specific. As a preventative, many workmen occasionally swallow a small quantity of the varnish.

The *theet-tsee* it-self forms a beautiful black colour, but to improve its brilliancy and transparency, the article covered with it is often polished in the same manner as the Burmese polish the fine marble, with petrified wood powdered very fine, repeatedly washed, and then dried ; and for this purpose, the petrified wood of a particular tree

called *En-gyen\** is esteemed. A little of some scented wood is added, but this, apparently, is not indispensable. This polishing powder is called *en-gyen-kyouk-tshoue amhonn*.

\* There are few colours which will preserve their tint when mixed with this varnish; vermilion answers best. The Burmese prefer a vermilion, which they make themselves, to that brought from China, and it is certainly of a much brighter scarlet. Only one man at the capital, and he is attached to the palace, is said to know how to make this vermilion, which is called *hen-za-pa-da gowé*, from the colour resembling that of the little scarlet seed with a black spot named *glycine abrus* or *abrus maculatus* in Marsden's *Sumatra*, 3rd edition, p. 171. There are two other descriptions of vermilion made at Ava, called respectively *hen-za-pa-da Ava* and *hen-za-pa-dah Gouk*, which last seem more like our red lead. The vermilion brought from China is called *hen-za-pa-da tshouk*, and the Burmese say that it is the refuse or ground of the finest kind, and that it does not mix well with *thect-tsee*. Red ochre or Indian red, called *myè-nee*, red earth, gives a duller colour, and is used for lacquered ware of the coarsest description. It is sometimes used also as a first coat, over which the vermilion is applied. These paints, when used, are first made liquid with a very small quantity of an oil brought from Laos, called *Shan-zee* or *Shan* oil, and then mixed with *thect-tsee*, in the proportion of three parts of the varnish to five of the vermilion. This *Shan-zee* is said to be extracted from the fruit of the *kunigen* tree, (*Dipterocarpus turbinatus*), the trunk of which yields the common wood oil used in the manufacture of torches at Tavoy and Mergui. The Burmese however say, that the Shans conceal the manner of making this oil, because if it could be manufactured in Ava, there would be no occasion for importing it from Laos. It sells at Ava for 4 ticals per viss. The *kunigen* tree, which is so abundant to the southward, and which affords the inhabitants there so cheap a substitute for candles, cannot be very common near the capital, where I have never seen a torch, the petroleum only being used by all classes for lights. A mixture of this Shan oil and *thect-tsee*, ten parts of

\* The same tree is mentioned in the inscription on the Rangoon great bell; see Asiatic Researches, vol. xvi, p. 271 and 276.—Gandama was born under this tree, and died between two of the same species. He was perfected into a Boddhi under another tree, the *Niwang* or *Baodi beng*, the *Ficus Religiosa*. I have never been able to get a specimen of this *Engyca* tree, although I am assured that it is to be seen to the south-east of Ava, and even at Moulmien, and in a fossil state portions of it are to be found all over the country between Prome and Ava.

the latter to three of the former, is used as a semi-transparent varnish. When put over any other than black it darkens the colour a little, but adds much to its brilliancy and transparency. The Burmese possess no really transparent varnish, and it would be satisfactory to know, if any could be obtained from the *theet-tsee*, by distillation or other means.

There are three descriptions of lacquered ware in Ava. The first, and by far the best articles, are brought from the Shan countries—*Shan-pyee-ga*; and *Lè-gya*, Dr. Buchanan's Lækhia, a Shan province, situate to the S. E. of Ava, is the principal place of manufacture. The Shan ware may be distinguished by the lightness and elegance of the manufactures, and the superior brilliancy of the varnish and colors. The next are those manufactured at a place called *Nyoung-oo*\*, and its neighbourhood, near the ancient capital, *Pagan*. These are generally distinguished by their being of yellow or green colours: and almost all the small betel boxes, *kæon-ee*, in use among the Burmese, are of this kind. The best of this kind are made at *Pagan* itself, and called after that town, but the larger proportion is named from *Nyoung-oo*. The last and worst description of articles is manufactured in the city of Ava and its environs, and these are to be distinguished by the coarseness of the work, its plain red colour, and the frame being generally of wood and not of basket-work. Most of the plain red large boxes with high conical covers, *thamen tsaouk-gyee*, and other vessels used by the Burmese for holding food, are of this description. The lacquered boxes from Laos have upon them tasteful figures and other ornaments of a beautiful black colour or of gold, and those from *Nyoung-oo*, have them of yellow or green colours. Many of these boxes are so thin that you may discern the basket work through the varnish. The best ware is tried by seeing whether the edges of two sides can be made to meet without cracking the colour or breaking the article. I believe none but a few Shan boxes will bear this test.

The different figures and ornaments on the lacquered ware are executed in the following manner, called *Yonon-tho*, or engraving after the manner of *Yonon*, which was the general term formerly applied by the Burmese to Northern Laos and Zenmay, but which, and some-

\* *Nyoung-oo* means Fig-tree Point. The name of this place, where Lieut. John North, one of our early envoys to Ava, died, and was buried on 30th August, 1755, has been strangely used. Capt. Baker writes it *Young-oo* and *Pegang Young-ue*; Symes, *Nwoun-doh*; Cox, *Gueanan Gu-cayne* and *Gucayen*; Crawford *Nyanng-ngu*; and Wallich *Gnaunc*. The Burmese lower classes scarcely pronounce the *nung* of *Nyoung*, which has led a friend of mine to write the name *Gnee-a-oo*.

times with *gyee* or great added, is the name now given to Cochin China only. After the last coat of varnish has been applied, and it is thoroughly dry, figures, lines, &c. are described by the lacquered ware being scooped or scratched, just deep enough to remove two or three coats of the varnish, with rude steel tools, either sharp pointed or having the point slightly divided. This last described instrument is called *tsout*: it is used like a gouge, and guided by the thumb of the left hand whilst the right is scooping out the lines. The former instrument called *gouk*, is often nothing more than a broken needle tied to the end of a small piece of stick, and it is used to describe the circular lines; the lacquered ware being turned round with the help of the knees and left hand against the instrument held steadily in the right hand. It is surprising how quickly the workmen use these rude gravers, which are sharpened with a piece of slate usually brought from *Shà-è-zettan* on the road to Arracan, and called *Shà-è-zet-tau-Kyauk*. When being sharpened, the instrument is held against the forefinger of the left hand, and the slate, moistened with a little spittle, is rubbed against it. The edge also of the slate on one side is made fine, for the purpose of being rubbed within the divided point of the *tsout*. When the figures and ornaments are furnished, a coat of vermilion and *theet see* is put over the whole surface of the ware, and allowed some days to dry. The ware is then placed on the lathe, and turned round against some wet bran pressed down upon it with the left hand, and occasionally washed in water. This process rubs off all the vermilion from those parts which are in relief. A second and a third coat of vermilion is applied, and partially removed in the same manner. It is then placed in the sun for a few minutes, and when perfectly dry, a coat of the semi-transparent mixture, before described, is put on, rubbed off with a piece of cloth, and a second coat put on, which is allowed some days to dry, for the Shan oil always takes a long time to dry. This kind of engraving is the most tedious and expensive, and it is called *Shan Yowon-tho*, the Shan *Yowon* engraving, from the circumstance of all Shan boxes being so ornamented. The *tsout* or *gouk*, somewhat in the manner of our wood engraving, scoops or cuts all the surface except the figures and ornaments required, which remain black, the colour of the original ground, whilst those parts only where the gravers have made hollows or incisions, are afterwards filled up with red. The *Shan Yowon-tho* executed by Burmese workmen can never be made to look so well as that done in the Shan countries, owing either to the *theet-see* not being so fresh and pure, as the workmen allege: or to the Shans making use of some other materials unknown to the Burmese, which last I am



used in filling up any little holes, and joining on the stands or different pieces together, and the separate parts of the frame-work of the high conical boxes are fixed together with this cement, which becomes as hard as wood, and which would really assist the famous project of converting saw-dust into deal boards. The ornaments like little rails, fixed around the sides of some of the boxes, are made with this *tha-yo*, pressed with little tin moulds or stamps into the pattern required, and then fastened on. A fourth kind of paste is made with the ashes of cow dung, *ngoisa gyee-bya*, sifted finely, and mixed with *theet-tsee*, which has been put over fire until beginning to boil. The two are then well mixed and beat together, whence this paste is called *tè tha-yo*, or "beaten *thayo*." This looks like putty, and is used principally by gilders in fixing flowers or other ornaments upon wood-work, to which it adheres very tenaciously; and before it hardens, it is so pliable and elastic, that it may be drawn out into the finest lines and twisted into any shape. But much of the cheapest and coarsest description of Japanned ware manufactured at Nyoung-oo, is said to have the basket-work covered with a paste of cow's dung and mud only, over which one or two coats of *theet-tsee* are applied. This paste is always liable to crack and chip off the basket work, and the Burmese consider this kind of manufacture, in which very little *theet-tsee* is used, as an imposition.

All the above descriptions of paste form good cements for joining wood-work. For this purpose, the best kind is a mixture of the bone ashes *tha-yo* with a little teak saw-dust; and I have found it answer as an excellent substitute for glue, not being so liable to be affected by damp weather. It is only longer drying, as much as five or six days. It answers very well also in filling up the cavities left in fine cabinet-work, when the thin black edging has broken or fallen off. When dry it must only be rubbed smooth and even with a stone, in the manner hereafter described.

To return to the cups, which the Burmese workmen prepared under my eye. On the second day, the rim of the cup was cut round smooth, and the fine description of basket-work at the top was scraped and thinned with a knife, so as to bring it more on a level with the other part. The hole at the bottom, where it is fixed to the form when being wove, was filled up with a little of the saw-dust *tha-yo*. The whole inside and outside, was then covered over with a paste made of *theet-tsee*, bone ashes, and saw-dust, three parts of bone ashes to one of saw-dust. The workmen called this the *tha-yo-gyan* or "coarse *tha-yo*," declaring that for this first coat of priming, this mixture of the

two was best, as adhering most closely to the bamboo basket-work. It was applied with the fingers.

At the end of three or four more days the rim of the cup was cut still more even, and the cup was fastened to a lathe, called *tset-khoum*, and the inside was ground perfectly smooth and even in the manner hereafter described. A coat of *ayo-tha-yo*, "bone ashes *tha-yo*," or *tha-yo akhy-au*, "fine *tha-yo*," was then put on with the hand in the inside, and laid smooth with the finger, occasionally dipped in water. At the lathe the left hand is employed on the cup, whilst the machine is turned with the right hand, which moves to and from the workman a long stick tied to a leathern string, that has two turns around the lathe. Forms or chucks of the size required, are fixed to the spindle of the lathe with little pieces of bamboo; and when the outside of the cup is to be turned, the cup is fitted to these chucks, which enter about an inch and a half within it. But when the inside of the cup is to be turned, a cylinder of coarse basket-work open at both ends, called *tsee*, is fixed to the chucks, and within this cylinder, the whole of the cup is lodged, and fastened, if necessary, with little slips of bamboo at the sides. To make the coat of coarse *thayo* perfectly smooth and even, the cup is smeared over with a little water and a kind of red earth, and is then turned against a piece of pumice stone, and occasionally moistened with more water. The cup was placed in the sun to become perfectly dry, before the *thayo* was put on. The large boxes with high tops are fastened to a different kind of lathe, like our centre lathes. The upper end is either inserted into one side of the lathe, or fitted on a pin there; and to the bottom is fixed a piece of wood, which revolves around another piece fastened to the other side of the lathe. The two sides of the lathe may be made to approach or recede as required, to hold the ware between them. The string is put round the box, and the left hand usually moves the stick, whilst the right holds the pumice stone. Usually, one coat only of *thayo* is put on the wood work of these boxes; but they are rubbed smooth and even, three times, with the different kinds of stone; once after the *thayo*, once after the first coat of varnish, and the last time, after a second coat of the varnish. The *thayo* is put on at once over the wood, and there are three coats of varnish before the vermilion is applied.

At the end of three more days the cup was again fixed to the lathe, and the outside was treated in the same manner as the inside had been before, the coat of coarse *thayo* on the outside being rubbed smooth and even, and when perfectly dry, a coat of fine *thayo* put on. The workmen said that it is better to do only one side at a time.

At the end of three more days the cup was fixed to the lathe, and the inside made smooth and even with a kind of sandstone, called *kyouk-pyen-gwè*, and a little water; then with a rag, and a little fine powdered charcoal of teak-wood and water, and lastly with a moist piece of cloth. When perfectly dry in the sun, a coat of plain *theet-tsee* of the best kind, or *theet-tsee ayoung-den*, was put on in the inside with the finger. This was done in the sun, to which the cup was afterwards exposed for about a quarter of an hour. The workmen seem to prefer always to use the varnish in the sun. Besides the *kyouk-pyen-gwè*, which is the same kind of stone as that on which the Burmese grind sandal-wood to rub on their bodies, there is a stone of a finer grain sometimes used, called *shwè gan-gyouk*, from the circumstance, I am told, of gilders using it to polish the articles they desire to gild.

At the end of four more days, the cup was fixed to the lathe, and the outside was treated in exactly the same manner as the inside had been on the preceding day, ground smooth, and covered with a coat of fine *theet-tsee*.

At the end of five or six more days, for the varnish did not dry sufficiently before that time, a second coat of the fine varnish, or *theet-tsee ayoung-den*, was put on the outside and inside of the cup.

Before applying a coat of vermilion the cup was fixed to the lathe, and the polish of the two fine coats of *theet-tsee* was removed by turning the cup against the stone *kyouk-pyen-gwè* only, and afterwards against some bran and water pressed upon it with the left hand. The object of this operation, as well as that of grinding with some powdered teak-wood charcoal and water with a rag, was to remove the transparent effect of the fine *theet-tsee* before the polishing powder above described, *engyen kyouk-tshowè-amhoun*, was used. In doing which, the cup was turned against the palm of the left hand, smeared with a little of the powder.

In gilding, the wood-work is primed two or three times with the *ayo-bya* or *phwè-bya thayo*, and rubbed quite smooth and even with the stone and water, before the gold leaf is put on, which is done, as Dr. Wallich describes, "by besmearing the surface very thinly with the varnish, and then immediately applying the gold leaf." The priming is, of course, here necessary to fill up the cavities in the wood, and produce an equal surface before the gold leaf is put on. A little piece of cotton is dipped in the varnish, and before the surface is dry, the gold leaf is put on with the thumb and finger, and gently smoothed over with another clean piece of cotton. The gilders also use a brush of the thickness of a man's thumb, with which

small pieces of gold leaf are taken up and introduced into cavities or hollow ornamental parts of the wood-work, in the same manner as our gilders use a squirrel's tail. This brush is made of the hair taken from the inside of cow's ears; and the workmen declared, that it requires an hundred cows to make one brush. I had a picture frame gilt, and although the gilding has not the lustre of one of our's, it has the advantage of remaining with the frame; for the Burmese priming does not break and chip off, as the coat of whitening over our picture-frame does. The Burmese have no idea of burnishing their gilding; and if their priming would take the burnisher, their gilding would not only equal our's in lustre, but being more durable, would be preferable. The workmen could make nothing of a dog's tooth, which I pointed out to them as a burnisher; but this was owing probably to our not knowing the exact time of applying it. The priming on their wood-work is about one-half the thickness of the coat of whitening on one of our picture-frames; but of course it could be made thicker if necessary, and it would be useful to know, if the gilding over their priming could be burnished. In Siam most of the gold leaf used for gilding is imported from China, but the Burmese prefer to make their own, and they beat it far too thin, for it is full of holes and so requires to be doubled in many places, which not only leads to much loss, but prevents the gilding so smooth as the Siamese gilding. They mix a great deal of alloy also with the gold of which they manufacture the leaf, contrary to what Colonel Symes was informed; and hence the gilding of all Burmese pagodas and public edifices soon looks dull and shabby, particularly where exposed to the weather. Few remains can be now traced of the gilded Kyoungs seen by Colonel Symes at Amarapoora, nor is there any gilding now to be seen on the great Arracan gun. The splendour of the king's palace at Ava, although the gilding has not been executed more than 8 or 9 years, is not so great as it must have been when Mr. Crawford visited this capital; and the gilding of the Shivedagon pagoda, at Rangoon, now looks very black and shabby; whereas at Bang-kok, I recollect the Portuguese consul pointing out to me the excellent state of preservation of the external gilding of a pagoda, which was described to have been gilded no less than sixty years before\*.

All the different purposes to which the *theet-tsee* is applied in this country, can scarcely be enumerated. It is *boiled*, and used for writing on polished tables of wood or ivory, particularly in the Pali character.

\* Gold leaf is fixed on cloth or paper by the Burmese, in a very simple manner, with only the milky juice of the country fig, *Udambar* of Hindústan, (*Ficus racemosa* or *glomerata*), called by the Burmese *Thaphanthee*.

The umbrellas of all classes are made with paper and two or three coats of varnish, over which, whenever required, gold leaf is easily put on in the manner above described. Almost all domestic utensils are made with this substance, and basket-work or wood. I should think very light portmanteaus or *pitaraks* might be made, by applying over a bamboo frame-work this varnish, and the *thayo*, which would fill up all the cavities, and render the articles impervious to water. Rattan might be too heavy, and the priming might not adhere so well to its polished surface. The *theet-tsee* would answer well as a preservative for the sides of ships and their standing rigging; I applied a coat of it, in the absence of paint, to the sides of some gun-boats, and found the material cheaper and much more durable than paint. By first applying a coat of the *thayo* or paste, the sides of a vessel might be made perfectly smooth and even, and impervious to water; and in this manner the Burmese finish their best war boats, which are afterwards gilded over if required\*. It is necessary to mention, that the surface of the *theet-tsee*, when kept, is always covered with 2 or 3 inches of water, to prevent the varnish from drying or becoming hard.

Observing that Dr. Wallich had never seen the *theet-tsee* in flower, I requested Dr. Richardson, during his verland journey last year to the frontiers of Manipúr, to bring me a specimen. He passed through extensive forests of the tree, from a place called Mya-goo, about 5 days journey from Ava, to the Manipúr boundary. The trees were very large, and had a beautiful appearance from being covered with flowers so abundantly that the leaves were concealed, and the trees looked one mass of white. The bark appeared quite dry, and no juice was oozing at the little slips of bamboo which he saw sticking in the trunks of the trees. The flower has a fragrant scent, resembling that of apples, and the Burmese eat the young buds in *currys*. The wood of the *theet-tsee* is of the colour and appearance of the red wood of the Malay countries. It is much used, converted into charcoal, by blacksmiths and others requiring a very hot and quick fire; and it is used also for such little articles of furniture as the Burmese can boast of.

\* Most of the lacquered ware is made round, in consequence of the convenience of finding the surface smooth on a lathe, but I have lately induced Burmese workmen to prepare articles of other forms, and they have begun to make ladies' square work boxes, and gentlemen's hats; which last will be useful in wet weather.

The account given under the article Japanning in Rees's Cyclopaedia of the *varnish* used in China and Japan, "composed of turpentine and a curious sort of oil," and "of the *lack*, sap, or juice of a tree, occasioning swellings in the hands and faces of the people who use it," answers a good deal to the *Shan* oil and *theet-tsee*, here described; yet the Burmese workmen, upon examining a piece of japanned-ware of China, considered it to be made of a different material, unknown to them.

I send with this paper, specimens of the lacquered ware, and the different materials used in the manufacture.

For the convenience of reference, I have numbered the whole as follows. [The specimens are deposited in the Society's museum.]

- 1.—Basket work of a cup completed.
- 2.—First coat of *theet-tsee* put on, rim cut, and fine basket-work on the top scraped.
- 3.—A coat of coarse *thayo* applied inside and outside.
- 4.—Inside and outside ground on the lathe.
- 5.—A coat of fine *thayo* applied inside and outside.
- 6.—Inside and outside ground again on the lathe.
- 7.—Two coats of plain *theet-tsee* applied.
- 8.—A coat of *Hen-za-pa-da Yowé*, or fine vermilion applied.
- 9.—Polished with *Engyeu* powder, after two coats of *theet-tsee*, and gilded at the bottom, to shew the Burmese style of gilding.
- 10.—The *Yowon T'ho* engraving, according to the *Shan* style.
- 11.—The *Yowon T'ho* engraving, filled up with *Hen-za-pa-da Yowé*—A coat of the semi-transparent mixture applied, and the specimen of *Shan* ware completed. But there was too much *theet-tsee* in the semi-transparent mixture, and hence the colour is too dark. The circular lines are coloured with the worst sort of vermilion, or *Hen-za-pa-da Gouk*.
- 12.—The *Burma D'ho* or engraving, according to the Burmese style, upon a coat of *Hen-za-pa-da Yowé*.
- 13.—The *Burma D'ho*, or engraving, filled up with yellow sulphuret of arsenic, or *tshé-dan*, and the specimen of Burmese ware completed.
- 14.—The *Burma D'ho*, or engraving, after 3 coats of *theet-tsee*.
- 15.—The *Burma D'ho*, filled up with green, or *atsein*, a compound of indigo and yellow sulphuret of arsenic.
- 16.—The first or finest kind of basket-work, called *Kyoung-lein-yet*.
- 17.—The third or coarsest kind of basket-work, called *Powet-kyoung-yet*.
- 18.—The second or middling kind of basket-work, with the form, or *poun*, on which it is woven.
- 19.—A course *Nyounge-oo* made *kwon-eet* or beetle box, supposed to have a priming of mud and cow-dung only.
- 20.—A fine *Nyounge-oo* made *kwon-eet*, or beetle box, such as is used by men of rank.
- 21.—An Ava-made *t,hamen-tsa ouk galé*, or small sized dinner-box, with conical top, before any *theet-tsee* is applied.

21½.—A ditto ditto, with a coat of *thayo* put over the wood, and ground smooth on the lathe.

22.—A ditto ditto, after the *thayo* or paste has been applied and ground smooth, and a coat of *thet-tsee* over all.

23.—A ditto ditto, completed, with the *Hen-za-pa-da* or vermilion applied. These small sized boxes, with conical covers, are used by the Burmese women in carrying food to the pagodas on sabbaths and holidays.

24.—A Shan-made *thamen-tsa ouk gyee*, or large dinner box, with conical cover, completed.

24½.—A Nyoung-oo *thamen tsa ouk-gyee*, or Nyoung-oo large dinner box, showing the Burmese style of engraving.

25.—A *bhec-ect* or comb box, before any *thet-tsee* is applied, being a Burmese lady's toilet box, to contain combs, oils, scents and false hair, sandal wood, and Chinese white lead; which last is used to put small round beauty spots on the face, like patches of our court plaister.

26.—A *tset-khoun* or lathe, with a form or chuck fixed on it.

27.—A *tsee* or cylinder form, with a chuck joined to it.

28 and 29.—Two bottles of *thet-tsee* of the first kind, or *Ayoung-den Thet-tsee*.

30 and 31.—Two bottles of the second quality, or *Thet-tsee-Anee-byau*.

32.—A bottle of *Shan-Zee*, or Shan Oil.

33.—A packet of *Hen-za-pa-da Yowé*.

34.—A ditto of *Hen-za-pa-da Awa*.

35.—A ditto of *Henza-pa-da Gouk*.

36.—A piece of *Shwé-gan-gouk*, or stone.

37.—A ditto of *Kyounk-pyren-gwé*, or stone.

38.—A piece of *Enggen-gyounk*, or fossil *Enggen* wood, used as a polishing powder.

39.—A piece of *Teng-wa* bamboo.

40.—A ditto of *Myen-wa* bamboo.

41.—A ditto of *Shwé-zettun-gyounk*, or stone.

42 and 43.—A *Tsout* and *Gouk*, engraving tools.

44.—A Shan-made *khoun-ouk*, or beetle box with high conical cover, such as ministers and men of rank use at Ava.

45.—A fine Shan-made *Ect-gyee*, or large round box, shewing the *Shan* style of engraving very perfectly.

46.—A common Nyoung-oo made *Ect-gyee*, or large round box.

47.—A parcel of Burmese gold leaf. The Burmese usually divide their gold according to a decimal scale of *mons*—ten *moo* gold is supposed to be purest, and the inferior qualities are termed 9, 8, 7, &c. *mon*, or this specimen is said to be 8 *moo* gold.

48.—A parcel of *Phwé-hya*, or paddy husk ashes.

49.—A parcel containing some *hartal tshé-dan*, or yellow sulphuret of arsenic.

50.—A piece of *thet-tsee* wood.

51.—An Ava-made *khwet-gyee*, or large cup, with a stand fixed to it.

52.—Pieces of bamboo, shewing how they are cut for weaving the basket-work.

## II.—Analysis of the Chinese Varnish. By Mr. I. Macaire Prinsep.

- [From the Memoirs of the Society of Physics and Natural History at Geneva, April, 1826.] •

As a valuable appendix to Major Burney's account, we insert in this place, the translation of a memoir by Mous. I. Macaire, on the chemical nature of the Chinese varnish, which, if not identical with, does not much differ from that of Ava.

“ The name of varnish was formerly given in the arts, to solutions of divers solid substances in appropriate liquids, susceptible of being spread easily over the surface of bodies, and by evaporation of the liquid of leaving a film of solid matter, more or less thick, to protect them from external influence. The essential qualities of a good varnish are, the formation of a continuous and smooth coat, not injurious to the texture or colour of a body; its rapidly drying and hardening, and finally its mixing well with different coloring ingredients. To these points artists have directed their attention; but although they may have succeeded well, their efforts have not yet surpassed nature, and the precious juice of which Eastern Asia possesses an inexhaustible supply, is as yet superior to the best artificial varnish.

The Chinese and Japanese had long employed this varnish, before we had any knowledge of it in Europe. The Missionaries sent to China, in the 15th century, were the first to give some crude notions of the nature of the coating found upon most of their works of art. In the 17th century, the Jesuits Martino, Martini and Kircher having spoken of it in more detail, a French hermit of the order of St. Augustin, father Jamart, found means to profit by the uncertainty of knowledge about Chinese varnish, and sold under this name a composition which he kept secret, and which, though certainly very different from the real varnish, had very much the appearance of it, and acquired general reputation in commerce. Many others sought to imitate or improve upon it, with combinations of balsams, gums, resins, volatile oils, &c., until at last father d'Incarville made known to the world, that the famous varnish employed by the Chinese to cover their furniture and utensils, was the natural product of a particular tree, which they called *Tsi-shu*, or varnish-tree.

Those who know with what vigilant jealousy the Chinese threw obstacles in the way of all intercourse with the people of Europe, will not be surprised at the uncertainty of data acquired by botanists, as to the name and locality of this precious tree, which has never yet been seen in Europe. Loureiro, who deserved the greatest confidence, because he alone had judged with his own eyes, inserted it as a new genus in his *Flora Cochinchinensis*, under the name of *Augia*, from *αυγη*, *splendor*. The generic characters given were, a small calix of a single piece, five oblong petals attached to the receptacle, a great number of stamina attached to the same point, ovary terminated by a style and an obtuse drupe flattened from the top, so as to resemble a lens, small, smooth, and enclosing within a pulpy envelope a similar flattened nut, having but one cell. Loureiro imagined there to be only one species, and that one the only tree which produced varnish; he called it *A. Sinensis*. It grows in Cochinchina, China,



Siam,—of a moderate height, its branches rise vertically and are furnished with *pennated leaves*, consisting of five pair of folioles entire, placed along a common petiole, terminated by a single one; the flowers are disposed on the summits of the branches, where they form panniculæ. To obtain the varnish, the bark is pierced, and a thick resinous juice exudes from the wound: it is either used pure, or mixed with different coloring substances. It is employed in India as a medicine, after boiling to deprive it of a very acrid volatile principle.

The Cochinchinese medical men administer the resin in pills, as heating, resolutive, emmenagogue and vermifuge. Upon this description, M. de Jussieu classed the genus *Angia* among the *Guttifera*, but Professor De Candolle remarked, that of that family there was not a single species with pennated leaves. The last character classes it naturally with the *Terebinthaceæ*, to which the chemical qualities of its juice also assimilate it; but according to M. de Candolle, the *Terebinthaceæ* never have the petals and stamina inserted in the receptacle. Mr. Lamarck refers the varnish tree or *Tsi-chu* to the Badamier, *Terminalia vernix*, of the family of *Myrobalsans*; its leaves oblong, linear and smooth, deprived of hair, distinguish it from the other *Badamiers*. It grows in China and the Moluccas, it contains in every part a milky juice, of so caustic a nature as to render its exhalations dangerous, and contact with the plant more so. When the trunk is of sufficient size, this juice exudes spontaneously, or through artificial fissures; it thickens and becomes brown and altogether black, when it has acquired its utmost consistence. While yet liquid, the natives apply it to the articles known in Europe, as “lacquered ware.” The caustic principle volatilizes while the varnish is drying; so that the vessels coated with it may be used for drinking with impunity. The seeds are even eaten, when roasted.

This description will not apply to the Chinese varnish, since this latter substance does not blacken in the air, and it is probable, that M. de Lamarck may have confounded it with the varnish of Japan, which is produced (according to Adamson) from a species of the Sumach tree, *Rhus vernix*. “This tree,” says the naturalist, “is poisonous, and produces on the skin, as does the *R. Toxicodendron*, effects analogous to the symptoms of crespelas. A white viscous liquor runs down from incisions made in the tree, which is caught in wooden baskets, and blackens in the air. It may be preserved in vessels covered over with an oiled skin, but it is far from equalling the varnish of China\*.”

M. Perrotet, returning from a voyage round the world, in 1823, sent a specimen of the Chinese varnish to Professor de Candolle, who kindly favored me with a portion for chemical examination.

The Chinese varnish is of a yellow colour, slightly brown, of a peculiar aromatic smell, of a strong taste, slightly astringent, affecting the back of the mouth, persistent; nearly resembling that of the balsam of Mecca or Copahu:

\* Dr. Wallich has raised the Burmese varnish tree into a new genus, *Melanorrhæa*, and has pointed out the distinguishing characters of the several trees yielding varnish, (*Plantæ rariores* 12.) The coincidence of the Chinese, Japanese, and Burmese names *tsh-tsi* need be no criterion of their identity, since the words merely signify *varnish-tree*, and would be applied to all that yield varnish. The resemblance between the *Angia* of Loureiro, the *Rhus Vernicifera* and the *Melanorrhæa*, are striking; it can hardly be said that the Burmese varnish turns black, it only appears so when very thick.—ED.

its consistence is viscous, like thick turpentine. It orms, when spread, a brilliant even surface, drying easily, and assuming a fine polish. It fixes well the colors usually mixed with it, as minium, cinnabar, lamp-black; and forms good colored varnishes, which do not scale off when dry. To mark its difference from turpentine, varnish, and balsam of copahu, whose physical and chemical properties are otherwise so analogous, I ground up with the latter some of the same colors, but found that the varnishes thus made would not dry; and after three months' exposure to the air, they still yielded to the finger, so as to be totally useless.

Poured into a vessel of distilled water, the varnish spreads upon its surface, in the form of a yellowish film, which by degrees absorbs water in its pores, and becomes white and completely transparent; so that it may be said to be *hydrophanous*, like some particular minerals. Turpentine has not the same property, but the balsam of copahu has it in some degree: on straining the varnish it becomes opaque, and soon grows yellow from the evaporation of the water it had taken up: the water acquires a slightly bitter taste. The varnish dissolves gently, in cold, and more rapidly in hot alcohol; water precipitates from it an abundant white resin. It is also soluble in ether and in cold spirits of turpentine.

Digested in boiling water, the varnish whitens and resembles curdled milk; its own peculiar odour is disengaged, and after long boiling, there remains a white resin, solid, brittle when cold, softening and melting in hot water, soluble in alcohol, in all proportions—whence water precipitates it in a white powder—soluble in turpentine, caustic potash, &c. Heated in a tube gradually raised, the resin gives out much water which it had dissolved: this water is strongly acid, and contains benzoic acid, as will be presently noticed. The resin deprived thus of the water it had absorbed, remains transparent and yellowish: when cold it is hard and brittle, softens and melts at the fire, and under a graduated heat gives out by sublimation white silky flexible crystalline needles of benzoic acid. Soon after a very acid water is disengaged, (acetic acid,) the resin blackens, and decomposition commences.

On examination of the water in which the varnish was boiled, we find that it reddens litmus, and has a slightly sour taste. Evaporated, it leaves a light residue soluble in alcohol, whence it is precipitable partly by water. This acid saturated with ammonia, acts with re-agents like the benzoic; it must have existed in the varnish in a free state to be thus separated by simple boiling; gum benjamin also and balsam of Mecca, when boiled in water, impart a marked acidity and of the same nature. To assure myself, that the acids so dissolved was positively the benzoic, (for I remembered that the Italian chemists had proved the existence of succinic acid in turpentine, and this might therefore be the case with the varnish):—I first sought to recognise the differences between the two, and was surprised to find, that it was almost impossible to distinguish them. In fact they both melt and volatilize, leaving a carbonaceous residue; both sublime in white, flexible, silky needles; the remarkable property enjoyed by the succinates of precipitating iron of a yellow brown, and forming a soluble salt with manganese, which proves so useful in analysis, belongs also to the benzoates. They precipitate in the same manner the salts of lead, silver, tin, and neither of them affect antimonial solutions. These two only, of all the vegetable acids, dissolve without decomposition in nitric acid, and are recovered unaltered on evaporation. Sometimes, it is true, a few red vapours arise, and when benzoic acid is so treated, on evaporation

of the nitric acid, a marked smell of bitter almonds is perceived, although on saturation with potash, no trace of prussic acid is found.

Many chemists have inclined to believe in the identity of the two acids, and have attributed the slight differences observable to the presence of foreign matter. Nevertheless in seeking some method of discrimination, I have observed two circumstances in which the benzoic and succinic acids behave in dissimilar ways.

1. With the salts of copper, a very neutral solution of benzoate of ammonia gives a pale blue ashy precipitate, while the succinate furnishes an abundant curdled deposit of a fine green; neither of the acids alone precipitating copper. 2. With the salts of cobalt, the succinate of ammonia hardly disturbs the liquid, and it is only after a day that a rose coloured deposit is perceived, while the benzoate throws down a copious flocculent precipitate of a pale rose colour.

By employing these two tests, I ascertained that the acid extracted from the varnish acted like the benzoic. I should add that, when I treated with nitric acid the residue left by the evaporation of the water in which the varnish had been boiled, I obtained, besides the unaltered benzoic acid, a small quantity of oxalic acid, which I attribute to the presence of the little gum which had rendered the alcoholic solution opalescent, but which was in too small a proportion to be separated.

If the varnish is distilled in a retort with water, there passes into the receiver an essential oil, white, transparent, swimming on the water, of a strong scent, similar to that of the varnish itself, of a very acrid taste, disagreeable and persistent, having all the properties of other essential oils, without any apparent peculiarity.

Boiled with dilute sulphuric acid, the pungent odour of the varnish disappears, and an iridescent white pellicle forms on the surface of the liquid, giving to the vessel and liquid, by reflection, a fine blood red or purple colour; but on removal from the fire, the liquid is seen to be colourless. The pellicle may be skimmed off in scales: it is dry, insipid, soluble in turpentine, which it colours yellow; insoluble in caustic potash; it becomes brown in alcohol and ether, by degrees losing this colour and imparting a milky tinge on solution: on the addition of a few drops of water, the alcohol becomes sensibly acid; heated *per se* the purple matter softens, melts, loses colour, turns black, and reddens litmus strongly; heated in boiling distilled water, it is also discoloured without imparting any tint to the water, which becomes strongly acid; and the residue dissolves entirely in alcohol with the aid of a gentle heat. Water renders this solution milky, and this residue appears to be nothing but resin little altered. The solution shewed indications of acid, which, saturated with potash, dried and strongly heated, gave out an odour of sulphurous acid, one of the characteristic marks of hyposulphuric acid; the residue was merely sulphate of potash.

The purple matter therefore appears to be a compound of resin and sulphuric acid modified in its composition, and to be nothing therefore but another form of artificial tannin. This led me to imagine, that the artificial tannin produced by the action of sulphuric acid on resin should give analogous results; and in fact, sulphuric acid diluted with twice its weight of water having been mixed with eclophony (resin) in powder, the liquid took a brown colour, and by the gentle heat of the sun disengaged sulphurous acid: the filtered solution evaporated and washed, presented all the characters of tannin. The excess of sulphuric acid having been separated by barytes, the liquid was evaporated, and the

salt disengaged by heat a smell of sulphurous acid, as an hyposulphate would have done. It appears to me, therefore, that we should consider artificial tannin as a combination of resin and hyposulphuric acid, which supposition is conformable enough with the facts that led to the discovery of this modification of sulphuric acid. Pounded resin digested with heat in very dilute sulphuric acid, does not however give rise to the purple matter: it merely takes a brown colour. Gum benjamin and balsam of copahu do produce it: turpentine does not: benzoic acid does not acquire a red colour under similar treatment.

It follows from the facts contained in this Memoir, that the Chinese varnish is composed, 1st, of benzoic acid; 2nd, of a resin; and 3rd, of a peculiar essential oil, and that it is only to the happy proportions of these three, and to the slight differences between their properties and those of analogous resins, that the Chinese varnish owes the superiority which renders it so precious in the arts."

### III.—*Summation of Polynomial Co-efficients.* By Mr. W. Masters.

It is stated in most of the treatises on Algebra, that, if a binomial be raised to any power, the sum of the numeral co-efficients of the terms of that power is equal to 2 raised to the same power; but I have no where met with even a most distant hint of the proposition (which I am about to demonstrate) that, the sum of the numeral co-efficients of any power of a polynomial is equal to the number of terms in that polynomial raised to the same power. This is almost self-evident; for if a binomial  $(x + a)$  be raised to any power, it is plain that the numeral co-efficients that appear in the developement originate not from  $x$  or  $a$  which are heterogeneous, compared with abstract numbers, but from  $(1 + 1)$  the co-efficients of  $x$  and  $a$ ; for while we develop  $(x + a)$  we at the same time develop  $(1 + 1)$ , and the figures that appear represent a certain power of  $(1 + 1)$ .

(1) Let  $(a + b + c + \&c.)$ ,  $(a' + b' + c' + \&c.)$ ,  $(a'' + b'' + c'' + \&c.)$ , be  $m$  sets consisting of  $n$  things each. If one set be taken, and one letter from it at a time, the number of combinations will be  $n$ ; and as the numeral co-efficient of each combination is 1,  $n$  likewise represents the sum of the numeral co-efficients of the combinations. Next, if one letter be taken at a time and two sets be used, the number of combinations  $= 2n$ ; and since the co-efficient of each combination is 1,  $2n$  also represents the sum of their numeral co-efficients.

If one letter be taken and three sets used,  $Cns. = 3n = S. N. Cts.$

If one letter be taken and  $m$  sets used,  $C. = mn = S. N. C.$

The co-efficients of  $n$  form the following progression:

1, 2, 3, 4, . . . . .  $m$ .

(2) Now take two sets, consisting each of  $n$  things; combine them by taking one letter at a time from each.

$a'a + a'b + a'c + \&c.$  (to the  $n$ th term)  $= n$  combinations.

$b'a + b'b + b'c + \&c.$   $= n$  ditto.

$c'a + c'b + c'c + \&c.$   $= n$  ditto.

that is, each of the  $n$  letters of one set forms  $n$  combinations with the letters of the other set: the number of combinations is  $n \times n = n^2$ . Since the numeral co-efficient of each combination is 1,  $n^2$  likewise represents the sum of their numeral co-efficients.

Next, let there be three sets, each containing  $n$  letters, taking two sets at a time, and one letter from each of those two sets at a time.

$$\left. \begin{array}{l} a + b + c \&c. \\ a' + b' + c' \&c. \end{array} \right\} \left. \begin{array}{l} a + b + c \&c. \\ a' + b' + c' \&c. \end{array} \right\} \left. \begin{array}{l} a' + b' + c' \&c. \\ a'' + b'' + c'' \&c. \end{array} \right\} \begin{array}{l} \text{There are only three} \\ \text{possible ways of ar-} \\ \text{ranging three sets tak-} \\ \text{en two at a time} \\ \hline 3. \ 2 \\ 1. \ 2 \\ \hline = 3. \end{array}$$

The first arrangement according to (2) produces  $n^2$  combinations of letters; the second  $n^2$  combinations also, and the third  $n^2$  combinations, the total number of combinations  $= 3 n^2$ , and for the same reason specified above,  $3 n^2 =$  the sum of the numeral co-efficients of each combination.

Next, let there be four sets, taking two at a time, and one letter from each as before.

The number of possible arrangements of four sets taking two at a time  $= \frac{4. \ 3}{1. \ 2} = 6$ ; according to (2), each of these six arrangements produces  $n^2$  combinations; the total number  $= 6 n^2 =$  also the sum of the numeral co-efficients.

Next, let there be five sets; then  $\frac{5. \ 4}{1. \ 2} = 10$  arrangements; each produces  $n^2$  combinations, the total number of combinations  $= 10 n^2 =$  also S. of N. C.

Next, let there be six sets, &c. &c. then  $\frac{6. \ 5}{2. \ 1} = 15 =$  number of arrangements; each produces  $n^2$  combinations, total number of combinations  $= 15 n^2 =$  S. of N. C.

Next, let there be  $m$  sets of  $n$  things: then  $m \frac{(m-1)}{1. \ 2} =$  number of arrangements, the number of combinations  $= m \frac{(m-1)}{1. \ 2} n^2 =$  also S. of N. C.

*Obs.* The co-efficients of  $n^2$  form the following progression :

Series..... 1, 3, 6, 10, 15, . . . . .  $\frac{m(m-1)}{1 \cdot 2}$

• Difference . 2, 3, 4, 5,

1. 2.

(3) Next, let three sets combine at a time, by taking one letter from each at a time. This is equivalent to combining two sets together, as was done in the preceding section, and then combining the result with the third set, thus,

1st set  $a + b + c$  &c.

2d set  $a' + b' + c'$  &c.

Result  $\frac{a'a + a'b + a'c + \dots \text{(to the } n\text{th term)} + b'a + b'b \dots \text{(to the } n\text{th term)} + c'a + c'b \dots \text{(to the } n\text{th term)}, \&c. = n^2$ , combinations;

3d set,  $a'' + b'' + c'' + \&c.$

$\frac{a'a'' + a''a' + \&c. \dots \dots \dots = n^3$  combinations;

$a''$  forms with the result  $n^2$  combinations; so does each of the  $n$  letters of the third set: therefore the total number of combinations formed  $= n \times n^2 = n^3 =$  also sum of numeral co-efficients.

Next, let there be four sets; combine three at a time, by taking one letter from each of the three sets at a time.

$a + b$  &c.,  $a' + b'$  &c.,  $a'' + b''$  &c. the combinations to be formed thus— $a a' a''$ ,  $a a'' a'''$ : since three sets out of four, are to be arranged together at a time, all the possible ways of effecting this, are

$\frac{4 \cdot 3 \cdot 2}{1 \cdot 2 \cdot 3} =$  four arrangements; now each arrangement ac-

cording to (3) produces  $n^3$  combinations: the total number of C. in this case  $= 4 n^3 =$  S. of N. C.

If  $m$  sets be taken,  $\frac{m \cdot (m-1) \cdot (m-2)}{1 \cdot 2 \cdot 3} =$  number of arrangements;

and number of combinations  $= \frac{m \cdot (m-1) \cdot (m-2)}{1 \cdot 2 \cdot 3} n^3 =$  S. of N. C..

The co-efficients of  $n^3$  form the following series:

Series 1, 4, 10, 20, 35, 56, . . . . .  $\frac{m(m-1)(m-2)}{1 \cdot 2 \cdot 3}$

Difference  $\left\{ \begin{array}{l} 3 \dots 6 \dots 10 \dots 15 \dots 21 \dots \frac{m(m-1)}{1 \cdot 2} \\ 3 \dots 4 \dots 5 \dots 6 \dots m. \end{array} \right.$

(5) Next, let four sets combine, taking one letter from each at a time, and forming combinations consisting each of four letters. This is equivalent to combining three sets, taking one letter from each at a time; forming combinations of three letters each, (as in the last section,) and then combining the result with the fourth set.

$(a + b + c + \dots)(a' + b' + c' + \dots)(a'' + b'' + c'' + \dots) = n^3$  combinations of three letters each, by combining  $(a'' + b'' + c'' + \dots)$  with the preceding

$a''$  will form  $n^3$  combinations of four letters each,

$b''$  will form  $n^3$  ditto of ditto, . . . then terms of the fourth factor will form  $n \times n^3 = n^4$  combinations of four letters each = S. of N. C. of these combinations.

Next, let there be five sets or factors, combining four at a time, and taking four letters from each at a time, then

$$\frac{5.4.3.2}{1.2.3.4} = \text{five arrangements of which the five sets are susceptible}$$

upon the condition required: but by the preceding result, each is capable of  $n^4$  combinations of four letters each; the total number of combinations =  $5 n^4$  = S. of N. C.

$$\text{Next combine } m \text{ sets: then } \frac{m(m-1)}{1.2} \cdot \frac{(m-2)}{3.4} \frac{(m-3)}{.} = \text{number}$$

$$\text{of arrangements; total number of combinations} = \frac{m(m-1)}{1.2} \frac{(m-2)}{3.}$$

$$\frac{(m-3)}{4} n^4 = \text{S. of N. C.}$$

The co-efficients of  $n^4$  form the following series:

|             |   |    |    |    |      |                      |                      |                    |
|-------------|---|----|----|----|------|----------------------|----------------------|--------------------|
| Series      | 1 | 5  | 15 | 35 | 70   | $\frac{m(m-1)}{1.2}$ | $\frac{(m-2)}{3.}$   | $\frac{(m-3)}{4}$  |
| Differences | 4 | 10 | 20 | 35 | .... | ....                 | $\frac{m(m-1)}{1.2}$ | $\frac{(m-2)}{3.}$ |
|             |   | 6  | 10 | 15 | 21   | .....                | $\frac{m(m-1)}{1.2}$ |                    |
|             |   |    | 4  | 5  | 6    | $m.$                 |                      |                    |

Without going into any farther detail's, we may proceed to make deductions: arranging the results already obtained, they will form the following series:

$$\begin{aligned}
 & 1 \qquad \qquad \qquad 2 \qquad \qquad \qquad 3 \qquad \qquad \qquad 4 \\
 m n, & \quad \frac{m(m-1)}{1.2} n^2, \quad \frac{m(m-1)(m-2)}{1.2.3} n^3, \quad \frac{m(m-1)(m-2)(m-3)}{1.2.3.4} n^4 \\
 & \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{rth}^* \\
 & \dots \dots \dots \frac{m(m-1)(m-2) \dots \dots \dots m-(r-1)}{1.2.3 \dots \dots \dots r} n^r
 \end{aligned}$$

The generating fraction is, for

\* rth means the rth term, as 2, 2, &c. mean the 1st, 2nd term, &c.

Term

$$2 \dots\dots\dots \frac{m-1}{2} n$$

$$3 \dots\dots\dots \frac{m-2}{3} n$$

$$4 \dots\dots\dots \frac{m-3}{4} n$$

$$r \dots\dots\dots \frac{m-(r-1)}{r} n$$

$$m - \{N+1\} - 1 \} = 0 \therefore N = m.$$

Let  $N$  be the number of terms ;  
the generating fraction of the

$$\frac{m - \{N+1\} - 1 \} n}{N + 1 \text{th term} = \frac{N}{N}}$$

Since the  $N+1$ th term  $= 0$ , the ge-  
nerating fraction must  $= 0$ ,

Therefore

That is, the number of terms is equal to the number of factors, or sets employed or developed.

The index of  $n$  therefore in the last term is  $m$ ; i. e. in the last term  $n$  is  $n^m$ ; as for the co-efficient of  $n^m$ , it is equal to the sum of the combinations that can be formed by combining  $m$  sets or factors, taking  $N$  sets at a time.

$$\text{This sum is equal to } \frac{m(m-1) \dots\dots\dots m-(N-1)}{1.2.3 \dots\dots\dots N} =$$

(because  $N = m$ )

$$\frac{m(m-1) \dots\dots\dots 1.2.3}{1.2.3 \dots\dots\dots (m-1)m} = 1$$

therefore the last term is  $n^m = (\text{S. of } N. \text{ Co-efficients of all its combinations. As the first term has } n \text{ combinations and the last } n^m, \text{ the last but one, or the } N-1 \text{th term will have } n^{m-1}, \text{ and its co-efficient will be equal to the sum of the combinations of } m \text{ sets or factors taken } N-1$

$$\text{sets at a time} = \frac{m(m-1) \dots\dots\dots m - \{ (m-1) - 1 \}}{1.2. \dots\dots\dots (m-1)}$$

$$= \left\{ \frac{m(m-1)}{1.2.3.4} \dots\dots\dots \frac{4.3.2}{(m-2)(m-1)} \right\} = m = \text{S. N. C. there-}$$

fore the  $N-1$ th term  $= m n^{m-1} = \text{S. N. C.}$

$$= \text{S. N. C.} \quad N-2 \dots\dots = \frac{m(m-1)}{1.2} n^{m-2} \text{ \&c. \&c.}$$

Since the foregoing formulæ for the number of combinations also represent the sum of the numeral co-efficients of each combination, these formulæ, considered as representing the sum of the combinations, will not at all be affected by the hypothesis that the  $n$  terms of each of the  $m$  sets or factors is the same, viz. that  $a', a'' \text{ \&c.} = a$ ;  $b', b'' \text{ \&c.} = b$ ;  $c', c'' = c$  and so on: the formulæ will, under this supposition, continue to represent the sum of the numeral co-efficients.



Now let it be required to develop  $m$  sets or factors, each consisting of  $n$  things or terms; viz.

$(x + a + b + c \&c.) (x + a' + b' + c' + \&c.) (x + a'' + b'' + \&c.) (\&c.)$  it is plain, that the development will be

$X^m + A x^{m-1} + B x^{m-2} + C x^{m-3} + D x^{m-4} \dots\dots\dots$   
 $Y x^2 + Y x + Z.$  Here it is evident, that,

$A = (a + b + \&c. a' + b' + \&c. + a'' + b'' + \&c.) =$  the sum of the combinations of  $m$  sets of  $n$  letters each, one set taken at a time, and one letter from that set at a time;  $=$  (as is shewn above) the sum of  $m n$  combinations of one letter each.

$B = (a a' + a b' + \&c. \dots a a'' + a b'' + \&c. \dots a' a'' + a' b'' \&c.) =$  S. of the combinations of  $m$  sets of  $n$  letters each, two sets taken at a time, and one letter from each of these two sets taken at a time;  $=$

S. of  $\frac{m(m-1)}{1. 2} n^2$  combinations of two letters each.

$C = (a a' a'' + a b' b'' + \&c. b' a' a'' + \dots a' a'' a''' \dots \&c.) =$  S. of the combinations of  $m$  sets of  $n$  letters each; three sets taken at a time, and one letter from each of these three sets combined at a time  $=$  S.

of  $\frac{m(m-1)(m-2)}{1. 2. 3} n^3$  combinations of three letters each.

$D =$  S. of  $\frac{m(m-1)(m-2)(m-3)}{1. 2. 3. 4} n^4$  combinations of four letters each.

$Z =$  S. of the combinations of  $m$  sets of  $n$  letters each, taken  $m$  sets at a time, and one letter from each at a time  $= 1 \times n^m = n^m$  combinations of  $m$  letters each.

$Y =$  S. of the combinations of  $m$  sets of  $n$  letters; taken  $(m-1)$  sets at a time, and one letter at a time  $= m n^{m-1}$  combinations of  $(m-1)$  letters each, &c.

Now, if we suppose  $a = a' = a'' \&c. b = b' = b'' \&c. c = c' = c'' \&c.$   $m n$  will represent the sum of the numeral co-efficients in  $A$ ;  $\frac{m(m-1)}{1. 2} n^2$  the sum of the numeral co-efficients in  $B$ ; therefore

the sum of the numeral co-efficients is in

$X \dots\dots\dots 1$

$A x^{m-1} \dots\dots m n$

$B x^{m-2} \dots\dots \frac{m(m-1)}{1. 2} n^2$

$C x^{m-3} \dots\dots \frac{m(m-1)(m-2)}{1. 2. 3} n^3$

$$\begin{array}{l}
 * \dots\dots\dots \dots\dots\dots \\
 Y x \dots\dots\dots m n^{m-1} \\
 Z \dots\dots\dots n^m
 \end{array}$$

therefore the sum of the numeral co-efficients in the expansion  $x^m + A x^{n-1} + B x^{n-2} + C x^{n-3} + \dots\dots\dots Y x + z$  is

$$1 + m n + \frac{m(m-1)}{1.2} n^2 + \frac{m(m-1)(m-2)}{1.2.3} \dots\dots m n^{m-1} + n^m.$$

But this series is evidently the expansion of  $(1+n)^m = (\text{number of terms in each factor})^m$ : therefore the sum of the numeral co-efficients of any power of a polynomial is equal to the number of terms in the polynomial raised to the same power.

IV.—*Geological Sketch of Masúrí and Landour in the Himalaya; together with an Abstract of the Thermometrical Register kept at Landour during the year 1831. By F. H. Fisher, Assistant Surgeon.*

The characteristic features of the primitive clayslate formation at Landour correspond so completely with those of similar districts in Europe, and tend so decidedly to favour the received geognostical arrangement of mountain rocks, that no one can survey them without strong feelings of interest and surprise; recognising at such remote distances the objects of early research and attention, and confirming as it were the result of former inquiry.

Viewing this mountain from the Dún, its general aspect at once determines its internal composition; the gentle acclivity, round-packed summit, and plentiful vegetation, indicating clayslate; its height, calculating above the level of the sea, is supposed to be about 7,000 feet, and its length ranging from east to west may perhaps average a mile; seldom affording a breadth on cleared sites of more than 100 feet.

Throughout this range, instances of some of the accidental rocks, peculiar to the primitive clayslate formation generally, occur.

Before describing these intruders, which appear to have thrust themselves perversely across the regularly disposed strata of the clayslate, it may not be foreign to note, as briefly as opportunity has afforded, the rocks which appear in the hilly route from Rajpúr to the Landour bazar†, assuming the site of the latter to be somewhat above the acclivity of the mountain.

† The convenience of geologists having been considered as little as others in the plan and construction of this route, any attempt at systematic arrangement must

Ascending from Rajpúr the road is cut through a bed of bituminous slate, passing through alum slate of a bluish green colour, both of which are much decayed, and then traverses clayslate of a faded red colour; black limestone next appears, frequently intersected by flinty slate and Lydian stone: about a quarter of a mile below Jeripani large beds of primitive gypsum\* with earthy sulphate of lime occur, and this may be considered the commencement of the Masúri limestone formation. The road continues with slight variations in a westerly direction, and displays huge beds of grey limestone with one remarkable tract of calcareous tufa; after which clayslate re-appears, generally much indurated, iron-shot, and containing beds of flinty slate, with irregular nodules and schistose veins of brown clay iron ore. The colour of the clayslate now passes into faded red, and running in a northerly direction the road leads to Landour, leaving the Masúri range to the westward.

The whole of this Masúri range is composed of huge masses of stratified limestone, inclining at a gentle angle to the east, presenting occasionally considerable breadth of summit, but never approaching the height of Landour. In colour it is of a bluish grey, passing into black and white, highly crystallized, and well suited for ornamental purposes; it yields excellent lime, but the natives are careless in the preparation of it.

The aspect of Masúri may still assert its claim to the picturesque, notwithstanding the merciless ravages of the woodman's axe amongst its withering beauties; precipices abrupt and imposing, moss-grown cliffs luxuriating in foliage, or nourishing creepers of the most lovely hue, must ever arrest attention, and steal admiration from the idlest observer. The simple minerals discoverable in this formation, are calcareous tufa, frequently iron-shot; calcareous sinter, white, brown, and yellow; calcareous spar in the primitive form; and sulphate of barytes; nodules of noble serpentine associated with hornblende slate, glassy actynolite, and earthy gypsum.

Leaving Masúri and passing through the Landour bazar by the road

necessarily be abandoned; mention therefore can be merely made of the various rocks as they occur in succession, without reference to strict geognostical situation. The distance included in the route is about five miles.

\* I consider this to be primitive from the considerable masses which occur; it varies in colour from brown to the purest white, the latter variety being highly crystalline; emits a strong smell of sulphuretted hydrogen when fractured; the same odour is perceptible in the water drawn from the stalactitic cave near Rajpúr. In large doses this water is but slightly cathartic.

above alluded to, we ascend by a small patch of grey limestone, and set foot on the clay slate of Landour\*.

\* It is of a faded red colour, frequently passing into black, bluish black, greenish grey, and light brown, disposed in large slates, inclining at a considerable angle in an easterly direction ; it is occasionally waved in its structure, and in the red varieties cleaves easily in the parallel of the stratum, presenting a glittering surface, owing to small particles of imbedded mica. The black and bluish black varieties do not yield so readily to the hammer ; they are tough, afford irregular fragments, and cannot be adapted to the purposes of roofing. The accidental rocks which occur in this formation may be thus enumerated : granular quartz rock† ; felspar ‡ ; flinty slate and limestone §.

They are all unconformable, crossing the clay slate at right angles, and dipping to the north.

*Abstract of a Thermometrical Register kept at Landour from the 1st of January to the 31st Dec. 1831. Thermometer kept in an open verandah facing the N.*

|      | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|------|------|------|------|------|------|------|------|------|-------|------|------|------|
| Max. | 47°  | 48°  | 64°  | 76°  | 85°  | 86°  | 70°  | 72°  | 69°   | 70°  | 62°  | 50°  |
| Min. | 31   | 31   | 40   | 44   | 60   | 60   | 61   | 59   | 51    | 51   | 42   | 30   |

## V.—*On Modes of obtaining Important Results by Simple Means.* By Capt. G. Twemlow, *Bombay Artillery.*

[Continued from page 70.]

### 2.—*Easy mode of casting masses of simple metals without the aid of furnaces.*

The native mode is to surround the mould (sunk in the earth) by a fire capable of keeping it hot, then to employ as many assistants with their small earthen pans, and hand-bellows, as may be necessary to fuse the requisite quantity of metal ; in this way it would not be difficult to cast a pillar of large dimensions, taking the precaution to have the mould strong, well bound and supported, the fire around it sufficiently intense, although properly covered in, and the assistants in sufficient numbers to melt the metal, and pour it into the mould, kept hot as long as requir-

\* Landour is separated from the snowy range by intermediate zones ; they all run parallel.

† Concretions not exceeding the size of a pigeon's egg, and of a milky hue, as seen on the site of the new Hospital.

‡ Compact felspar of a greyish colour, distinctly stratified, slaty in the small, and by the aid of a glass small acicular crystals of hornblende may be sometimes discerned ;—cleared site near Mr. J. Lloyd's grass hut.

§ But sparingly found of a pink colour, coarse in structure, and rather tough ;—site of the tennis court.

ed, to enable them to fill it. This mode it is evident would not answer well for mixed metals, nor for metals difficult to fuse. The writer casts his 18 pr. brass naves in this mode, each man bringing his seer of molten metal and pouring it out of earthen pans into the mould, kept surrounded by fire; and he has no doubt but a brass pillar or statue of one thousand seers in weight, might be cast in the same simple mode, by a series of circles of a thousand pans and a thousand bellows surrounding the fire-embedded mould,—not that we would adopt the pans, having a knowledge of furnaces.

3.—*Strength of powder may be too great in mining.*

A curious instance of simplicity on the part of natives, leading to useful results, may be mentioned relative to the operation of blasting rocks: the miners represented, that the government powder was not of the proper kind; that it blew out the tamping, without moving the rock, or if a very small quantity were put in, no effect was produced; whereas the common country powder was excellent; with it they could make great progress, but not so with the government powder. On going to the spot, this was speedily remedied by mixing one handful of saw-dust with each charge or handful of powder, so as to decrease the velocity of ignition, and to admit of the expansive fluid acting on greater space. It is believed that in mining operations generally it would be well to mix saw-dust with the powder, when a sufficient chamber can be formed, or to adopt some other mode of producing gradual expansion and reiterated concussion.

4.—*Mode of boucheing iron Guns, at a siege, or on emergency, without the aid of a regular drill l. the.*

Should the vent of an iron gun become so much enlarged as to be unserviceable, before a siege has been brought to a favorable termination, a new vent may be applied on the spot, thus; let the gun be withdrawn from the battery, and be thrown down close to the nearest convenient tree; and fixed on a block at the proper angle: insert a stout trunk of another tree in the ground six feet apart from the standing tree; pass a stout flat lever bar from one to the other, fixing one end to the standing tree, but so as to move up and down on the smoothed front of the other or inserted trunk: thus we have a simple boucheing machine or drill lathe.

In the mean time, the train artificers will have bent an axletree, or any other convenient piece of iron, into the shape and form of a brace, whilst other smiths will have forged out a four-cornered square cutting tap; with this square tap inserted in the brace, the artillery men may be set to work to enlarge the injured vent. The smiths mean time are

to be set to work to forge the screw tap for cutting out the female screw. Others will beat out the cold iron rod for the male screw, which is to form the vent.

When after successive enlargements of the female screw in the gun metal, it is brought to fit exactly the male, the latter is to be turned in screws with the requisite force to make it amalgamate with the gun metal, particularly in the lower two-tenths, which should purposely be left rather tight.

It is believed, that the chief thing to be looked to in boucheing iron guns, is to secure a very firm fixture below, by leaving the last two-tenths of the female screw tighter rather than the rest, so that force may be used to make the male screw bite into it.

We are told that guns have now spare screw vents for insertion on demand ; but is it not probable that if the first screw is destroyed by intense heat, that the gun metal around it will have run, proportionately ? In fact it admits of doubt, whether when a screw vent is destroyed by hard firing, it can be extracted by other mode than boring it out with taps and a brace.

5 — *To make fuzes on emergency.*

It has occurred that a bombardment has been stopped for want of fuzes in the shells, and that have been sent for, express, from the nearest magazine—the following plan of making fuzes on emergency might be of use in such a dilemma.

Procure some battery planks or any thick wood of two or more inches in thickness, according to the length of the fuze required ;—stretch a carpenter's marking line along the centre of the smooth plank, and mark a line the whole length ; parallel to that line, and on each side of it, draw other lines at the requisite distances for the thickness of the fuzes—on those lines bore holes (with a brace, auger or *burma*) as deep as the fuzes are required to be long ; and having the fuze composition ready, drive it into the holes ; cut off the fuzes, wrap them, and send them into battery for use ; there is no reason why they should not be as good fuzes as need be, provided the composition is properly prepared and driven.—Persons who have to blast rocks may in this way make fuzes, wherewith to ignite their mines ; for composition they should use mealed powder and charcoal.

6.—*Simple mode of quickly obtaining a light on service.*

Tear off a bit of cloth, moisten it in your mouth, put it into a pistol over a small charge of loose powder, fire the cloth against a bank, or ground, and the rag will give you a light.

7.—*To set fire to combustibles with musketry.*

Cast (in a greased piece of old musket barrel) solid cylinders of lead. Cut them into lengths of one inch; bore a hole in each to within two-tenths of an inch of the opposite end. Drive meal powder or other composition (according as the burning is required to be quick or slow) into the holes after the manner of fuzes, and when the composition has been driven to within one-tenth of an inch of the top, pass a strand of quick match transversely through the sides, as is done with fuzes.

These fire slugs fired horizontally will set fire to *whatever retains them*; or if fired at an angle will fall burning, if the composition is appropriate.

In Europe, rifle shells and other inventions are under trial, for setting fire to artillery ammunition waggons, and to other combustible machines. It is probable that the above is as simple and effectual a mode as could be managed with infantry; and in street combats might be made very formidable. If such weapons come into general use, artillery will be obliged to have their ammunition boxes made (as in fact it might be well if they were now made) *cellaret fashion*\*, to admit of the interior tier or row of holes being filled with shot or other resisting non-combustible material (even earth would do), to protect the powder which would be placed in the centre.

8.—*Simple Alarm bell for private treasure or plate chest; or for public treasure tumbrils, to prevent the necessity for double sentries.*

Sling a bell inside the chest, so attached to the lid that it cannot be got at from the out-side, and may have room to swing free. An attempt to force the chest or remove it will inevitably cause the bell to sound an alarm, and if it does not deter the depredators will give the master time to defend his property, or the guard to turn out.

VI.—*State of Science in England.*

To the Editor of the Journal of the Asiatic Society.

SIR,

Having felt much interested in the discussion which has for some time been maintained in the scientific journals at home, respecting the decline of science in England, I take the liberty of sending you a few observations on the subject; which, if they should not be deemed too presumptuous, you would oblige me by inserting in your valuable Journal.

\* In making cellaret fashion ammunition boxes, the partitions should be put in from below in grooves; the bottom of the box to be afterwards screwed over them and well clamped—it is a safe mode of carrying fixed ammunition.

In Dr. Brewster's Journal for October, which I have just received, there is a somewhat tart critique upon a pamphlet written by a foreigner, and prefaced by Mr. Faraday, on the subject I have mentioned; and by it my attention has been particularly excited. This foreigner comes forward in defence of the scientific men of England, against the allegations of Sir H. Davy, Messrs. Babbage and Herschel, Sir J. South, and others: and it seems sufficiently rash for a foreigner to enter the lists with natives, or for any man to dispute the testimony of witnesses so competent, upon such a subject. Indeed it appears absurd to impugn their evidence upon any ground whatever, whether of motive, capacity, or actual information. Yet there may be no absurdity in inquiring, what the real amount of their testimony is. And I cannot but think there is something radically delusive in the phrase, "*Decline of Science in England*," which has been adopted to express the conclusion to which their depositions lead. For surely it could not be intended, that there is a literal decline of science in England, in such a manner that any thing previously known or acquired has been lost, or is beyond the reach and attainment of the present generation of our scientific men; or that the circle illuminated by scientific information and accomplishments is contracted, and the votaries of science in England are decreasing in numbers. No one would credit such testimony, by whomsoever it was advanced. But in what other sense can there be said to have been a decline of science in England, unless it be that there is not the same progressive activity in science which there was some little time ago? Now if this be the decline of science meant, we may—nay, I suppose, we must—admit it. But in what is it either wonderful or alarming? It is in strict analogy with all other strenuous movements. They have their irresistible impulses with succeeding pauses, in which strength is gathered for new and still stronger efforts. What have we lost that has brought us up to the present point of scientific progression? The human mind in Great Britain has not yet given any symptoms of dotage. Its powers remain in their full strength. And there are now multitudes in their cradles, and multitudes more unborn, who will bring to scientific inquiry as acute penetration, as profound abstraction, and as inventive a genius as any of their forefathers. The original faculties, by the exercise of which science is to prosper, are unscathed; and the facts which we are now slumbering over, will, in due time, strike on the minds of those who are to be our future Newtons, or Davys, or Herschels, or Babbages, or Brewsters, and enkindle glorious conceptions to dazzle succeeding generations by their splendour and majesty.



When thought is free, these are things that will neither come nor go at the bidding of state patronage.

I would not question a single fact alleged by the eminent men who originated this controversy. Nor can they be blamed for calling public attention to the decline, (if it must be called so,) which they deplore. On the contrary, they are much to be praised, and some of the admonitions they have given, deserve the most attentive consideration. Yet the general scope of their remonstrances and their recommendations does appear not a little at variance with philosophical character. "Science languishes for want of royal patronage, rich emoluments, and ribbons; stars, garters, and noble titles: let it have these, and it will be sure to prosper." Such is, I think, no unfair representation of much that they have advanced. Now these gentlemen are not of opinion, that England is in a state of original ignorance and destitution of science, but that it has merely sustained a relapse from allowed and indubitable eminence. They feel that but a short time ago, she possessed a galaxy of great men, which enabled her to enter into no dishonorable or unequal competition with all the science of the world; and their wish simply is to see her again invested with an equal glory. Upon the principle, that like causes produce like effects, one would have thought they would not have propounded the notions they have. For, observe the names which are adduced as lately the glory of England, and the loss of which has been the "death-blow to English science." They are "Sir H. Davy, Dr. Wollaston, Dr. Young, Mr. Watt, Dr. Marcet, Mr. Gregor, Dr. John Murray, Mr. Chenevix, and Mr. Smithson Tennant." And which single individual of all these was indebted in the slightest degree to royal patronage, or public endowments, or the ambition of rank and titles, for one tittle of his fame or usefulness? Indeed the inquiry, applied to them singly, becomes absolutely ludicrous.

We have had science then, by the safe and sure operation of knowledge gradually spreading over the minds of our countrymen. We have already by experiment ascertained the natural history of scientific discovery; the causes and the developments of its growth.

- We know it to be certain, that if the seeds of science be freely scattered by the winds, they will find their proper soils and localities, and come forth in a rich and natural harvest.

Why then should we reject or despise what has been established by such proof? and still more strange it is, to recommend the cultivation of science, by means with which it has no affinity. What kind of genius is it that is to be expanded by places, pensions, and titles? Are scientific

men envious of the brilliancy of Poet Laureate rhymes? Or worse, would they have science, too, oppressed with the administration of a plethoric hierarchy? Would they fatten it into indolence by inalienable endowments? Or would they disturb its serene atmosphere by the storms of rivalry and ambition after secular preferments and distinctions? It is most marvellous, that of the two noblest and purest things in the earth, religion and science, we should be told, on such high authority as Lord Plunkett in the one case, and Mr. Babbage in the other, that they will not exist unless nourished with *money*—they will have no brightness, unless tinselled with the gewgaws of a vain life. Such a sentiment ought to be scorned.

No civilized government can carry on its operations without patronizing science, for the single reason that it needs both its men and its materials. They are indispensable in innumerable ways for the efficiency of its army and its navy, for its surveys at home and abroad, for its mint, and for many other purposes: and in these things all kinds of science are brought into requisition. This sort of patronage is wholesome; and we have only to wish that it were more wisely distributed. But there appear to be some who would attach rather curious functions to Government, as the great patrons of Science and Art; functions which would require a peculiar Board for the purpose of pensioning all savans, painters, and poets, whose wits cannot keep them; and investing with baronetcies, or lordships, or earldoms, or dukedoms, men who ought to thirst for such things as the glory of discovering the alkaline metals, or shewing a list of 700 double or treble stars, or producing the calculating machine. As I have said, a civilized Government must of necessity patronise science, and Governments must likewise be the greatest patrons of science; but I cannot see that they are under any obligation to dispense a gratuitous patronage, or that they would do any thing but harm by such a thing. Because of their responsibility to those whose money they spend, they are bound to require a *quid pro quo* in every part of their expenditure. Government is the greatest individual patron of science, but if the community do their duty, their combined patronage will throw that of the most liberal Government almost into insignificance; and it will flow through a thousand channels which no state patronage could have reached, and where alone the coming Davys, and Watts, and Murrays, and Tennants, are to be found and nourished.

Let scientific knowledge continue to be industriously diffused; and it will awaken the energies of such men as Sir James Hall and Sir J. South, and many others who might be mentioned, whose place it is to patronize, not to ask patronage: or if it fails to do this generally,

it will at least produce in men of property that sympathy for the objects of scientific men, which will ensure them the means of applying all their faculties to the best advantage. All wealthy men are as much bound to dispense a portion of their revenues in the promotion of science, and in every other noble and generous enterprize, as the Government under which they live. Let them therefore be called upon to rouse themselves for the more extended performance of this duty. And let those who enjoy such honours and emoluments as science already possesses, shew by their superior diligence and success, that there is some virtue in the secular advantages which they possess, raising them as scientific men above those who are destitute of them, before the dangerous experiment be made of increasing such stalls and dormitories.

There appears to me something so portentous in this matter, that I should like to see it fully discussed upon principles that approve themselves to sound reason. But I must leave it to abler hands.

I am, Sir, &c. &c.

J. MACK.

[On this subject we refer our readers to the valuable remarks of M. Biot, inserted among the Scientific Intelligence of the present number.—ED.]

VII.—*Memoranda regarding the Difference between Morning and Evening Altitudes, for Ascertaining the Apparent Time on board ship.* By Captain D. Ross, *Marine Surveyor General.*

With most navigators, when quitting a port, it is usual to ascertain the deviation of the chronometer from mean time by altitudes of the sun taken either on shore with an artificial horizon, or by that of the sea from on board ship. These altitudes are generally taken before noon, and seldom, I believe, is the deviation of the chronometer ascertained by altitudes taken in the afternoon; but from the long experience I have had, I am led to believe, that to approximate to accuracy, it is right that altitudes should be taken on each side of the meridian at the place of departure; for it will be found that in cases where the difference of longitude between it and a distant station is to be measured, if the result of altitudes taken at the latter in the afternoon be compared with those taken in the forenoon at the point of departure, they will frequently give a longitude differing two or three miles from a deduction of the same measurement made by comparing two forenoon observations together, and in such cases, there may be an uncertainty to that amount, in fixing the position of a rock or other danger. If at the point of

departure the deviation of the chronometer is ascertained by both morning and evening observations, and these be compared with altitudes taken at the new station, corresponding as to the time of the day, the results if not agreeing will differ but little. •

On one occasion I found a difference of the nature alluded to above amounting to eight miles; for I anchored off one of the Piscadare Islands, near Formosa, and at about 8 h. A. M. took several altitudes for the chronometers, after which we proceeded nearly west from the anchorage, apparently 16 miles both by log and by the distance of the Island from us; we then anchored, and at 3. 30 P. M. the result of several observations taken and compared with those taken at 8 A. M. placed the ship but 8 miles west of the anchorage, when it was quite evident we were at least double that distance. Thinking these observations might be faulty, I took several others, but at about 5 P. M. and the results of the latter corresponded so nearly with those taken at 3h. 30m. P. M. as to satisfy me that the difference did not depend on error in the observations, and made me continue at anchor until the next morning, when observations were again taken and compared with those made the previous morning at the anchorage near the Island; they gave our difference of longitude 16 miles, agreeing with the log and apparent distance of the Island from us; here was an instance in which had not the island been in sight, I should have laid down a danger 8 miles short of what it should be, and should undoubtedly have attributed the difference to the effect of a current setting against us.

It is well known that in straits or confined navigation, owing to the changes which take place in the horizon, correctness is scarcely attainable in observations taken on board ship: I have often found it so, and am of opinion, that in the vicinity of shallow banks, the result of observations taken on ship board will be also generally found much at variance.

In the instance I have just stated, the bottom to the westward of the ship was formed by several ridges of sand lying in a north and south direction, having 7 or 8 fathoms water on them, with deeper channels between.

The part of the horizon above which the sun's altitude was measured was remarkably bright, and I have thought that some unequal evaporation might have caused the horizon to appear higher in that quarter.

I have found that observations taken in the vicinity of Sagar were not to be depended on, although there is apparently a clear horizon before you.

Latitudes taken afloat with much care will never agree with those taken on shore with an artificial horizon, and when the sun is to the

southward, will always be found more southerly by a mile or perhaps two.

I think there is little doubt, but that we need some correction for, the mutability of the horizon at sea, and that probably its amount might be ascertained by a series of observations with the dip sector, and a close attention to the state of the atmosphere : my own experience leads me to the conclusion, that equal altitudes observed by the horizon of the sea without this check on board ship, are always subject to errors of an irregular nature.

## VIII.—SCIENTIFIC INTELLIGENCE.

### 1.—*Mr. Alexander Kroma de Körös.*

The Viceroy and several noblemen of the Hungarian dominions, having learnt that Mr. de Körös, their countryman, was travelling in the East for the prosecution of researches connected principally with the origin of the language and people of Hungary, voluntarily subscribed £140 for the furtherance of his enterprising object. The money has just been received through a mercantile house in Calcutta, along with a handsome letter from the Baron Niumann, Secretary of the Austrian Legation at London. Mr. de Körös however has declined accepting it in the shape of pecuniary assistance to himself, and has been only induced to retain it, on the persuasion of his friends, for the purchase of Oriental manuscripts for the library of one of the principal universities of his native country.

### 2.—*Hügl Ice Manufactory.*

It may not perhaps be uninteresting to some of your readers to know the result of the experiment for keeping ice, and the reason of the late sudden failure of the supply. This is in part to be explained by the last having been an unfavourable season for the manufacture, so that although great preparations were made, the quantity obtained was by no means commensurate with the money expended ; and so peculiar are the agents to be provided against, in this hot climate, that in our present state of knowledge, experience alone can guard against their influence. That experience in a certain degree may be supposed to have now been obtained, and next year it is hoped, from additional preparations for its production, and precautions for keeping it, a supply of ice may be expected during a much longer period than has hitherto been known in Calcutta. The advantage that ice affords for cooling water, wine, &c. and the simplicity of the means to be employed for obtaining its full effect, must be already known to most of your readers ; but I suspect the cheapness of the luxury has not been properly appreciated, from the ignorance or carelessness of servants to whom its management is too often left. I have frequently had opportunities of observing this, and even the possibility of its not always accomplishing the object becomes apparent, when I have found servants, who had observed that it ought to be kept *warm* (surrounded with blankets), thrust it into warm water, the better to insure the keeping of the precious deposit. If care be taken to have it kept in a hard lump, and surrounded with blankets, it keeps very well for 12 hours,

during a hot day ; and when used skilfully, the following I find to be the quantity required for reducing the temperature.

Ice.

|  |                   |                            |
|--|-------------------|----------------------------|
| Maret, French bottle.....                        | } 3 chitaks. .... | } as cold as can be drunk. |
| Water, ..... ditto.....                          |                   |                            |
| Soda Water, stone ditto. ....                    |                   |                            |
| Sherry, in English ditto, .....                  | 4 chitaks. ....   | } ditto ... .. hard.       |
| Jelly, in a large wide mouthed glass bottle..... | 4 ditto ... ..    |                            |
| Butter, 1 chitak to 4 of butter.....             | ditto.            |                            |

W.

### 3.—Mergui Dye Wood.

Several specimens of a red wood were lately sent to Mr. G. Swinton, by Mr. Maingy, Commissioner on the Tenasserim coast, with a view to its examination as a dye wood. The *Rebecca*, on which the first samples of the plant were shipped, having been burned, nothing was then known of the tree. It was stated by Mr. Maingy, to differ from the *Theet-tsee* or Burmese varnish tree, which is also used in dying clothes of a red color. The effects of the juice of the red wood tree were described as similar to those occasioned by the *Theet-tsee*. The Burmese were said, when employed in collecting the wood, never to fell a tree for that purpose, but to search for trees that have been blown down, and in which no sap is to be found. It only bears seed once in 7 or 8 years: the Burmese do not extract the dye (probably from their having another tree which yields it in great abundance). The same tree is said to abound in Penang, but there the wood is red throughout, and is constantly employed as a dye by the Malays and Chinese.

A number of experiments made at the request of Mr. G. Swinton, by Mr. Thomas Speir, upon the Mergui dye wood, prove that it affords, with the mordants commonly used by dyers, colors equally bright and of a more permanent nature than those of most other dye woods. On the other hand, there seems a material objection to its success in the small quantity of coloring principle it contains, as compared with the generality of other woods and roots now in use: and it appears that the color is only found in trees of full growth, and only in the heart of the wood; the young trees are of a white or light straw color: indeed the branches of grown trees are white and the stems also, until their size exceeds that of the human body. The colors imparted to silk with different mordants were as follows:

1.—*Muriate of tin*, *sp. gr.* 1.185, with 5 parts water. Three shades of orange, varying with the temperature of the bath and the time of immersion.

2.—*Acetate of alumina*, *sp. gr.* 12. of *Twaddle's Hydrom*. Two shades of flame color.

3.—*Acetate of iron*,  $7\frac{1}{2}$  of ditto. Two shades of drab.

4.—*Ditto*, with a weak decoction of galls. A fine black, two shades.

5.—Mixed with *manjit*, a variety of red and pinks are obtained, but not perhaps equal in intensity to those of the *manjit* alone. The chief attraction of this wood as a dye, is the orange color which it yields with the aid of muriate of tin and acetate of alumina, of a great variety of shades.

These results shew that the Mergui wood is deserving of further attention, and that it may become eventually an important article of commerce with our posses-

sions on the Tenasserim coast. A small quantity of the wood has, we understand, been sent home to the Honorable the Court of Directors, for the purpose of being examined as to its dyeing properties, compared with other known dye woods.

[From duplicate specimens of the wood, leaves, and seed just received, it turns out that the tree in question is the *thit-tsi* or varnish tree, *melanorrhœa usitata* of Wallich: the above notice of its properties as a dye forms however an addition to our knowledge of the tree.—ED.]

#### 4.—Decline of Science in France.

In the *Journal des Savans*, Jan. 1831, is a note by Professor Biot on the subject of Mr. Babbage's reflections on the supposed decline of science in England. He deprecates the fatal example which has been set by a man of such distinguished talent, in decrying the institutions of his country, and introducing dissensions among those who should be occupied in fortifying the bulwarks of science, while he gives arms to her numerous enemies, always ready to ridicule and undermine her jealous ascendancy. The example has already been followed by other illustrious men, with the augmented bitterness of personal controversy; and a torch of discord is introduced among the combustible materials of our scientific bodies, which neither the late distribution of titles and pensions by the Government, nor the establishment of Associations for the promotion of science in different parts of the kingdom, can now extinguish\*.

M. Biot concurs in lamenting the neglect which such men as Dalton, Ivory, Young, Brewster, and Herschell, have suffered from their country; and grants that the abstract sciences have with us been abandoned for the more attractive paths of popular knowledge, the sure roads in England to preferment in the church, the law, the shipping and manufacturing lines: but in drawing a parallel between England and France, Mr. Babbage is thought to have laid too much stress upon the political honors and distinctions lavished upon men of science in the latter country. "It is," says M. Biot, "a remarkable moral effect of the distinction of ranks so strongly defined and so continually felt in England, that an abstract philosopher like Mr. Babbage, should be brought to confess honorary titles to be satisfactory and grateful to the intellectual class! Doubtless when such distinctions are accorded to merit, the intention should be duly appreciated, but the idea of any precedent or right should not for a moment be entertained." M. Biot makes the following just reflections on the French system of education.

"The immense development of the sciences in France, during the last 40 years, appears to us to have been produced by two causes very different from those pointed out by M. Babbage: two potent causes, of which one exists still, but the other has long ceased to act.

"The *still existing* cause is, the publicity of our higher grades of instruction, and its perfect independence of all pecuniary contributions paid by the auditors. It is thus open to every intelligent mind in a state competent to profit by it. The endowments, liberally assigned by the country, allow the

\* We observe in the *Philosophical Magazine*, that at the grand scientific Reunion at York, committees were established for the promotion of science, and that Major Benson, (W. H. Benson, Esq. C. S. ?) Sir Edward Ryan, Mr. Calder, Mr. J. D. Herbert, (Captain Herbert ?) and Mr. J. Prinsep, were appointed a sub-committee for India. No diploma has however yet reached Calcutta, and we trust that the increasing contributions to our Journal are the best guarantee of the non-decline of science in this part of the world!—ED.

professors full liberty to consult only the wants of science, in the tenor and depth of their lectures.

"The lectures delivered at the *College de France*, the *Jardin des Plantes*, and at the *Bibliothèque Royale*, have thus no need of a large audience; and with most of them, if a crowd were attracted, it would be the best proof that their object was not attained. It is far otherwise in England, even in the most recent and liberal institutions. Take as an example the London University: its buildings are superb; its scale of studies is drawn out on the most elevated views; the chairs are occupied by very able men; the auditory is numerous; but the emoluments of the professors depend chiefly on the fees of the scholars, whom it becomes necessary to please by suiting the grade of lectures to the capacity of the majority. This system may be very well for the elementary courses, but it interdicts all attempts at the more refined branches. A professor must be warmed by super-natural zeal, or nobleness of mind, to work at once against his popularity and his interest! and experience in fact shows that even the most distinguished men will rather condescend to lower their powers and become intelligible to the multitude. This general want of elevated courses, accessible to the talented few, and consecrated exclusively to the highest branches of abstract science, forms a void in England, a sort of precipice which arrests the progress of the master spirits by whom otherwise the sciences would be cultivated most successfully.

"The second cause which in our opinion gave a stimulus to sciences among us, was the political and moral state of the public mind at the renovation of order in 1791.

"A mad and atrocious revolution had destroyed our universities, academies, and other establishments of instruction. When the reign of terror subsided, some men devoted to science, and who had continued to cherish her in secret, Monge, Berthollet, Fourcroy, and Guyton, undertook to restore her temples, and they did it with a grandeur of conception which some may think gigantic, but which was admirably fitted to produce a great excitation in men's minds. A normal school was designed, to which pupils should be sent from all parts of France; the professors named were LaGrange and Laplace, who never would have been heard delivering their thoughts in public, had it not been for this revolution; with them were associated Berthollet, Haüy, and Monge himself, whose zeal had kindled general enthusiasm. In these unusual *comitia* of the sciences, philosophical discussions were opened on certain days, and such pupils as Fourier then started individual doubts to men whose genius had hitherto but spoken in general terms to Europe at large: at the same time Monge, the indefatigable Monge, set up a Polytechnic School, on an extensive and liberal plan, where, animated by his presence and impulse, the youth of France heard with an indescribable enthusiasm, lectures delivered on all parts of the Physical, Mathematical, and Military Sciences, by the first men of those days.

"Moreover these fundamental institutions were followed up by a general system of open public schools through the departments; where professors, occupied solely with such objects, spread around them the knowledge required by the generality of the population. These appointments, paid but poorly, brought nevertheless a feeling of independence and consideration:—they were then honorable; and this sentiment, joined to the complete liberty they enjoyed, fired the professors with the ambition of distinguishing themselves by works of instruction or research in the line of study they had embraced. Hence arose the multitude of first-rate elementary books we now possess, to which is mainly owing the renovation of scientific education among us.



"These, in our opinion, are the true causes which reanimated the sciences in France after the storms of 1793, and which have contributed to raise them to the eminence they now enjoy, much more than all the decorations, duchies, ambassadorships, and marquises ever lavished on their professors."

We must conclude our extracts with the professor's mortifying picture of the reverse now manifest in the state of French education.

"The central schools exist no more: the hand of power has broken them up, as too active instruments of intellectual development. From motives much the same, the system of education at the Polytechnic School has become less elevated and less general. These two blows at progressive improvement, have already enfeebled the study of the higher mathematics, which now only languishes in a few chairs in the *College de France*; so that unless measures be promptly applied, in a short time hence English savans will no longer say that they have abandoned the field of competition in *the calcul* without hope!"

5.—*Letter from Abdül Majid on the subject of the Arbelon Problem.*

[Literally translated.]

"I have heard that a certain talented individual was attracted by my demonstration relative to the Arbelon, and approved the reasoning, but being anxious to render it clearer, he came forward with amendments, and said out his say. I shall therefore acquaint him with a piece of my condition; that from the commencement of my youth, after picking up into my mantle the gleanings of dates and grapes from the gardens of science, I became a lecturer on traditional and intellectual sciences to the wits and the knowing ones of brilliant genius. I conversed with the generous sages, and repulsed him who was destitute of steadiness, so that it was my custom to move my tongue only when necessary, and to alter my conversation according to the condition of him whom I addressed, agreeably to the alteration of manner. Woe is me, then, that that knowing genius did not direct his view to the qualities of him to whom I had addressed myself, whose exalted name is indicated by this enigmatical symbol. He was satisfied without my multiplying or amplifying words to his lofty dignity and his enlightened sagacity; and this eloquent sage and perspicacious preceptor, through the perfection of his genius, by a mere glance at my abbreviated paper, made himself acquainted with its essence, and requited me above what I deserved. Now necessity calls upon me to gallop the horse of my pen into the hippodrome of explanation, as I before interpreted it to his excellency, the centre of the circle of science and politeness, the circumference of the diameters of dignity and generosity, the learned, the intelligent editor. I shall therefore first recite the enunciation of this figure, and secondly the first abbreviated explanation, and thirdly its clear and detailed explanation, and if (your correspondent) is satisfied with what I say, shall have attained that which is the object of my hopes, and the end of my labors. Deo adjectori gloria.

COUPLET.

Be gracious; to the uninformed your pardon free present,  
For clemency in mighty men is surely excellent."

*Note.*—We thank the learned author for the above complimentary epistle, and for his revised solution of the problem, which in its new shape is sufficiently clear for the most rigid demonstrator; but having published already a second version of the problem, we trust our limited space may be pleaded as an excuse for omitting his present demonstration.—ED.

IX.—*Proceedings of Societies.*

## 1.—ASIATIC SOCIETY.

*Wednesday, the 2nd May, 1832.*

The Hon'ble Sir C. E. Grey, President, in the chair.

1.—Mr. Pearson was proposed as a member by Mr. J. Prinsep, seconded by Mr. Wilson.

2.—The secretary submitted Bills for Rs. 346. 1., the amount of sundry Books purchased for the Society.—*Ordered*, that the amount be discharged.

3.—Read a letter from Dr. Royle, acknowledging the receipt of a letter addressed to the Court of Directors by the President on the part of the Society.

4.—The Secretary reported that difficulties had arisen with regard to the payment of Mr. Bruce's legacy, and recommended that the Treasurers, Messrs Mackintosh and Co. be authorised to apply for and receive the sum, which was accordingly resolved.

5.—Mr. Calder offered to the Society for purchase, a copy of the Baron Cuvier's last edition of the *Regne Animal* and *Histoire des Poissons*, at the invoice cost and charges.—*Resolved*, that the offer be accepted.

6.—Submitted an estimate from Mr. J. Prinsep of the expence of relaying the lower floor of the Society's house.—*Resolved*, that the measure be carried into effect under the supervision of a committee of the Society of the following Gentlemen—Mr. Gordon, Captain Forbes, Captain Jenkins, and Mr. J. Prinsep.

7.—*For the Library*.—Extracts from the Proceedings of the Society of Natural History in the Mauritius, presented through Dr. Casanova.

A copy of India's Cries to British Humanity, presented by the author.

Meteorological Registers for the months of January, February, and March, 1832, presented by the Surveyor General.

*Resolved*, that the thanks of the Society be presented to the Donors of the above.

8.—*Literary*.—A paper was read by the Secretary, entitled "Notices of the Life of Budd'ha."

[We hope in a subsequent number to present our readers with this interesting paper at length, and shall not therefore here attempt an analysis of its contents,—*ED.*]

## 2.—MEDICAL AND PHYSICAL SOCIETY.

*The 5th May, 1832.*

Assistant Surgeon J. T. Pearson, Bengal Service, stated his wish to return to the Society, and have his name replaced in the List of Members, in conformity to the resolution passed on the 4th April, 1829, which was complied with accordingly. D. McLeod, Esq. Deputy Inspector General of Hospitals of H. M. Service at Bombay, and John Stokes, Esq. Surgeon in His Highness the Nizam's Service, were proposed as Members by Messrs. Wilson and Twining. S. Ludlow, Esq. Superintending Surgeon, Bengal Service, was proposed by Messrs. Hutchinson and Egerton, and O. Wray, Esq. Surgeon, Bengal Service, proposed by Messrs. Garden and Tytler. Dr. W. C. West, President of the Medical Board of Chili, and Dr. Joseph Passaman, of Chili, were proposed as Corresponding Members, by Dr. Casanova and Mr. Twining.

The following communications were then laid before the Society.

1. Remarks on Cholera, by T. E. Baker, Esq.

2. A letter from Mons. Desjardins, Secretary to the Society of Natural History of the Mauritius, inclosing the proceedings of that Society up to 23rd November, 1831.

3. A communication on Vaccination, from Dr. Casanova.

4. A second report on varioloid Diseases, by H. S. Mercer, Esq.

5. A letter from F. P. Strong, Esq. presenting a work, published in 1653, by Dr. Hermannus Vander Heyden, of Ghent; containing an account of Cholera Morbus, and several other diseases then prevalent in Holland.

6. Dr. Hennen's Work on the Medical Topography of the Mediterranean; presented by Dr. Burke, for the Society's Library.

7. Mr. Corby's work on Cholera; presented by the author.

8. A short statement drawn up by a native, relative to an injury of the hip joint, of 10 months duration; and the patient whose case was related, came before the Society for examination.

9. A letter from M. Tierney, Esq. inclosing a copy of a communication from Sir M. Tierney, relative to the efficacy of Cajeputi Oil in Cholera; 50 drops are recommended to be administered in half a wine-glass of tepid water, and repeated every half-hour, until 250 or 300 drops have been taken. Sir M. Tierney states this remedy to have been used successfully in the severest cases of Cholera; and that two or three doses, if given early, are usually sufficient to arrest the disease. The statements of the effects of Cajeputi Oil, in Cholera occurring in Calcutta, do not correspond with the good effects, which by the above account appear to have followed its use in England; that medicine having proved entirely inert when administered under circumstances which authorised expectation of the patient's recovery by the uses of ordinary remedies; as much as six drachms by measure having been given to one patient in the course of five hours without the least effect. By a report published at Madras, it appears that Cajeputi Oil has been recently tried in H. M. 54th Reg. at Trichinopoly, during a severe epidemic visitation of Cholera; the effects of that remedy are stated to be very temporary, and by no means so beneficial as Mr. Hamilton, the Surgeon of the Regiment, had been led to expect.

The following papers were then read and discussed by the meeting.

Dr. Casanova's replies to the questions proposed by the President at the last meeting of the Society; namely—1st. Whether natural small-pox ever succeeds to a vaccination, in which the specific characters of the vaccine disease have been developed.—2nd. Whether a person having had the true vaccine disease, and having been thereby protected from variola for a certain time, may become afterwards liable to contract the natural small-pox.—3rd. Whether the true vaccine disease, by transmission through numerous individuals, be preserved unchanged, or be capable of undergoing any particular alteration, whereby its prophylactic properties are diminished; or if the virus be deteriorated or capable of change in different climates.

The author observes, "This is the question which agitates the public mind; shall we be safe from small-pox, if we are vaccinated?" He then offers the following replies to the queries; 1st, he has sufficient reasons for asserting, that in general the individuals reported to have had variola after vaccination, have in fact either had spurious cow-pox; or that the disease which has supervened after vaccination, instead of being variola, was merely one of the numerous exanthemata which resemble variola in some respects, but are exceedingly different in many of the essential characters. He goes on to state, that vaccine lymph taken from a perfect vesicle, and used at the same time in several subjects, is liable to produce genuine vaccine in some, while an imperfect vaccine may be developed in others; and supports this statement by reference to printed reports of numerous experiments made by Dr. Romay and himself at the Havaannah, in 1825; which authorise him to say, that spurious vaccine may repeatedly affect the same person, but when the true vaccine has been developed and gone through its regular course, the person is during the rest of his life insusceptible of either true or false vaccine disease, or of the natural small-pox. He farther refers to experiments made in various countries, which tend to confirm his opinions: the most remarkable statement which he points out is the summary of observations made by 43 medical men at Philadelphia in 1828, relative to a variolous epidemic, which raged in that city; where 80,000 vaccinated persons resided; and it appeared that only one death from variola took place on that occasion, among the above number of vaccinated persons.

With respect to the 2nd question, Dr. C. does not consider that his opportunities for investigation authorise the expression of a positive opinion; but he has never met with a single case that would support the conjecture of some physicians, that the security afforded by vaccination against variola is liable to wear out. He proposes that the subject should be submitted to the test of experiments; but as several years would be requisite to settle the question in this way, he observes, that so many medical men must now exist, who having been vaccinated formerly, and afterwards repeatedly exposed to variolous contagion annually, he thinks an appeal to our professional brethren in this country may be at once conclusive. With respect to Mr. Mercer's seven cases reported at the former meeting of the Society, he only acknowledges one to be variola (case 4), and that

there is no evidence of the true vaccine having been previously developed in that case: moreover, as there is no proof that any of the cases had ever been exposed to variolous contagion, in the interval between their alleged vaccination and the appearance of the eruptive disease which formed the subject of report at the last meeting; there is no reason to believe, that those individuals were ever insusceptible of suffering from variolous or varioloid contagion; he contends that we have no reason to believe, if susceptibility to variola be once destroyed by true vaccination, that persons are ever afterwards liable to suffer from variola. Dr. Casanova further says, that before we can acknowledge a renewed susceptibility to variola, in a person who has been once protected, we should ask two questions; 1st, What reason have you for believing that this person has gone through the regular course of true vaccination? 2nd, What reason have you for believing that this person has subsequently to vaccination been exposed to variolous contagion, without contracting small-pox?

In reply to the 3rd question the author states, that either vaccine virus taken from an unhealthy person; or lymph from a perfect pustule used to vaccinate an unhealthy person; may certainly degenerate into an humor *sui generis*, and produce a disease which affords no protection against small-pox. The particular disease stated as likely to influence the character of the vaccine, and to impair its prophylactic properties, are various cutaneous affections, which have been generally acknowledged to be adverse to successful vaccination; and some disordered conditions of the absorbent system, which do not appear to have been before particularly alluded to; but which the author asserts, have an unfavorable influence, in as much as we are protected against variola, only by the vaccine producing a constitutional as well as a local affection, which specific constitutional affection may be frustrated by a disordered condition of the absorbent system. The author also states, that cases have occurred, which render it probable, that the influence of vaccination is altered when several diseases of the mucous membranes occur during its progress, namely, aphthæ, chronic gastro-enteritis, and gonorrhœa. The author having, in concert with Dr. Romay, been engaged in making numerous experiments relative to the vaccine disease, thinks he is authorised to say, that he does not see any reason to acknowledge that vaccine matter is capable of decomposition or change, except from the effects of exposure to air, humidity, or light; and he considers that with due care in its transmission, the specific properties of vaccine remain unaltered.

Mr. Mercer's paper is in continuation of his report read at the former Meeting. He observes that small-pox has been frequent and fatal among both Europeans and Natives; and a large proportion of the mortality has occurred in persons advanced in years, and comparatively few in children. The author alludes to the frequency of rubeola and varicella, as well as of small-pox, this season, and gives a sketch of the distinctive characters of the two latter diseases, according to the best authors, which must be familiar to the profession. Three cases are there detailed, which may be numbered in continuation from those stated in the last month's circular.

CASE VIII. A woman of European parents, 26 years of age, had fever on the 28th March; vomiting took place, and the face was flushed. On the 30th an eruption of numerous small pimples appeared; on the 5th April the face was swollen, and the pustules very numerous, and filled with a thick opaque fluid; many of them coalesced: there was slight soreness of the throat, but no salivation, and no fever after the eruption appeared. On the 10th day of the eruption and 12th of the disease, the pustules were drying quickly on the face and some parts of the arms; and on the 19th day of the eruption a second set of crusts fell off. This person had been vaccinated by Mr. Shoolbred when an infant; one vaccine cicatrix is visible, of the size of a garden pea, imperfectly marked with central depressions.

CASE IX. An Indo-Briton, 26 years of age, had fever on the 4th April, which increased till the 7th, unattended with vomiting, except when medicine was taken. On the 7th April an eruption of numerous small papulæ appeared, some of which on the 8th contained an opaque fluid, and on the 10th some of them on the hands coalesced; on the 12th desiccation commenced, and on the 14th the scabs began to fall off. This person had been vaccinated at the age of 4 or 5 months by Dr. Hare; there is a small superficial cicatrix on the left arm slightly pitted.

**CASE X.** An European man, 26 years of age, became feverish on the 8th April; the pyrexia increased, and on the 11th, an eruption of small red pimples appeared and the fever subsided. On the 12th there were about 160 small pustules over the body, those on the face containing a yellow fluid. On the 17th April, some of the pustules had dried, and on the 18th most of the scabs had fallen off from the face, but some of the eruptions on the feet then contained a bluish-colored fluid, and were surrounded by a light red circle about  $\frac{1}{4}$  of an inch broad. This person was vaccinated in England when an infant, and has on his left arm an oblong cicatrix  $\frac{3}{4}$  an inch in length, the surface of which is pitted. All the cases mentioned in Mr. Mercer's former report recovered.

The author is inclined to think from the cases he has met with, that the opinions of some medical men may be in some degree confirmed, viz. "that no greater security is afforded against a 2nd attack of variolous disease by inoculation of small-pox, than by vaccination; and that after a certain lapse of time, the cow-pox loses its power as a preventive of small-pox;" yet, he says, in the greater number of instances of variola supervening on vaccination, the disease is much modified and of a mild character. The author mentions the experiments of Dr. Wolde, reported in the 109th No. of the *Edinburgh Medical and Surgical Journal* for 1831. Dr. W. had re-vaccinated 100 persons of various ages in Hanover, of whom 20 are represented to have had a perfect vaccine vesicle. Mr. Mercer's report concludes with a very copious extract from the same Journal, relative to the identity of Variola, and the Vaccine disease. The author of that article, Dr. Sonderland, of Barmen, states that the Vaccine disease may be produced in the cow, by covering the animal with a blanket that has been on the bed of a patient who has suffered severely from small-pox, placing another blanket similarly exposed to the variolous contagion, in the stall, so that the animal shall breathe the exhalation from the infected blanket. In a few days the animal is stated to be seized with fever, and on the 4th or 5th day the udders and other parts covered with a hard skin, are said to be affected with an eruption that assumes the appearance of cow-pox, and becomes filled with lymph, which on being used to inoculate the human subject, will produce the vaccine or protective pock. It is but justice to this very interesting subject to state, that Mr. Mercer has made the experiment of covering two cows with cotton clothes that had been on the persons of small-pox patients, but the animals have neither had fever, variola, nor the vaccine disease. In this country it is of vast importance to have the experiment repeated, to verify the fact, that we may always be able to produce the Vaccine disease when it is most required.

A letter from Mr. Mercer, subsequent to this report, mentions two additional cases of varioloid disease, viz. a man aged 27, and a woman aged 24, both born of European parents. The man is stated to have a well-defined vaccine cicatrix on each arm: the woman also bears an imperfect vaccine cicatrix on each arm, both these patients having been vaccinated in infancy. They have a numerous eruption, which in some places is confluent; but they are going through the disease favorably.

Dr. Baikie's observations on the climate of the Neelgherry Hills; and its effects on the sound, and on the impaired European constitution, are prefaced by an account of the weather at Ootacamund. The extreme annual range of the thermometer in the shade is stated to be between  $42^{\circ}$  and  $73^{\circ}$  Fahrenheit, but the diurnal range is rarely so much as  $11^{\circ}$  or  $12^{\circ}$ . The annual fall of rain does not exceed  $42\frac{1}{2}$  inches, and the Barometer's annual range is not great. The elevation of Ootacamund is stated to be 7,197 feet above the level of the sea, and the highest summit of the Neelgherry range is 8,429, being not very different from that of the convent of the Great St. Bernard, in the Alps, and the city of Quito, on the Andes. The S. W. monsoon sets in about the end of May, and lasts till the end of August. The N. E. monsoon begins late in October, and is usually attended with high wind and rain. The greatest heat is experienced in April and May, when however the mean monthly temperature is from 60 to 63. The atmosphere generally, is stated to be remarkably dry, elastic, and exhilarating; highly favorable to European constitutions; consequently the station is deemed an excellent residence for invalids, from the plains of the Deccan, or from the damp hot climate of Bengal. When invalids can choose the time they will proceed to the Neelgher-

ries, April is considered the best month to arrive there; as the transition of temperature from that of the plains is then less than at other seasons of the year. On first arrival at that temperate district, some persons experience slight embarrassment of respiration, and occasional dyspeptic symptoms; which are in some measure ascribed to the elevation of the station; but principally to a slight degree of congestion of internal organs; especially the lungs and liver; arising from the abrupt change of temperature. The climate is stated to be especially favourable to children, who quickly acquire all that alertness, activity, and rosy complexion, so remarkable in the most healthy parts of Europe.

The author next proceeds to specify in detail the effects of the climate on convalescents, and those who were labouring under the chronic stages of several of the more important diseases of India; numbers of whom have been sent to that station. In convalescents from dysentery, and those who had long suffered from the most obstinate chronic dysenteric affections; the best effects were experienced from a residence at Ootacamund: convalescents deriving early and decided benefit from the change; and many inveterate chronic affections which could not be cured at other stations, were soon restored to health by the aid of medicines. The treatment to which Dr. Baikia, from experience, gives a decided preference, is the combination of Ipecacuanha and Extract of Gentian, sometimes united with Blue Pill, and aided by application of leeches when any acute local symptoms required their use: and *a very careful attention to regulated diet, in small quantity.* By these means, the more distressing symptoms were often mitigated after the second dose of medicine; and a week's perseverance in the same remedies, generally sufficed to overcome the most obstinate attacks. Dr. B. has nearly abandoned the exclusive use of Calomel, since this plan of treatment was brought to his notice; he states, that the treatment now followed is more efficacious, more speedy, and more certain than any other; the patients being less liable to relapses than when the mercurial plan of treatment was trusted to. The author mentions, particularly, an inveterate case of chronic dysentery, in which repeated relapses had occurred; and almost every article in the materia medica used in such complaints had been employed in vain; at last, Ipecacuanha and Extract of Gentian were tried, and quickly checked the disease. The patient, who had been long in a most wretched condition, was soon restored to the state of a healthy and robust man. In this case even the Blue Pill proved injurious.

Convalescents from fever derive benefit on arrival at that station almost equal to that experienced by those who have suffered from dysentery. Those persons who were attacked with fever and sufficiently near to be removed to Ootacamund during the progress of the disease, or at its commencement, derived the utmost benefit from the change of climate.

Pulmonary affections, when not so far advanced as to preclude reasonable hope from change to any good climate, find great benefit from residence at this station. And in fact, all cases where debility and exhaustion are the principal affections to be removed: and an uniform elastic, cool, dry, and bracing atmosphere the principal desideratum, the climate of the Neelgherries may be recommended with the utmost confidence.

The diseases which derived comparatively less benefit from the climate of the Neelgherries, are Intermittent Fevers and Hepatic diseases; in which a favorable change is neither so certainly, nor so generally, to be expected; unless the patients be in a very advanced stage of convalescence, and in fact, suffering chiefly from debility; in such cases, and especially after a short sea voyage, these patients recover rapidly: but if they arrive at the hills with much remains of active disease, they become the subjects of tedious medical treatment: the causes of which are clearly shewn to be the internal congestion inseparable from abrupt transition to an elevated and cool climate.

Mercurial Rheumatism, after the treatment of various acute diseases by Calomel, appears to have been a frequent ailment among the convalescents sent to the station at Ootacamund. Dr. Baikia's favorite prescription is Infusion of Sarsaparilla in lime-water, as recommended by Mr. Brodie, according to the following formula.

Sarsaparilla Root, bruised, 3 iiss. Sassafras Root; Guaiacum Wood, rasped, each 3 ii. Liquorice Root 3 i. Recent lime-water, 18 ounces, macerated for 24 hours,

near the fire, and then strained. The whole of this infusion to be drank in the course of the day, at three doses.

The Report concludes with a Table, shewing the ailments of 155 convalescents and sick, who had been under treatment at the Neelgherries; viz. Hepatic diseases 49—Dysentery 28—Fever 23—Mercurial Rheumatism 10—Cephalalgia 5—Various other maladies 40. These had been under treatment between the 1st March, and 1st December, and only six cases are reported "*not better*;" these were 1 Dropsy—2 Hepatitis—1 Rheumatism—1 Intermittent Fever, and 1 Cephalalgia. Of the 155 cases, some of whom were in a most lamentable state from protracted Chronic disease, 80 were cured, and 13 died. Among the deaths were six of Hepatic disease.

### 3.—AGRICULTURAL AND HORTICULTURAL SOCIETY.

*Meeting of the 3rd May, 1832, at the Townhall.*

Sir Edward Ryan in the Chair.

Mr. John Willis Alexander was admitted a member of the Society.

The following letters and papers were read :

From Mr. Swinton, Chief Secretary to Government, forwarding another and larger sample of the foreign or ship-borne cotton, found by Major Burney at Yandaboo in Ava.

From Mr. Willis, reporting on this sample. The thanks of the Society were voted to Mr. Swinton, and the Secretary was requested to forward to him a copy of Mr. Willis' report.

The Secretary was also requested to have the cotton carefully separated from the seed, and retained as a specimen, while the seed itself should be forwarded to Mr. De Verine to be sown at Akra.

From Mr. Truscott, Officiating Commercial Resident, Culpee, requesting to be supplied with foreign cotton seed for the purpose of introducing its cultivation largely into Bundelcund.

From Dr. Carey, on the native method of manufacturing paper in India, as requested by the last meeting of the Society.

Resolved, that so soon as Baboo Ram Comul Sen furnishes his paper on the same subject, both essays be sent to Government, for the purpose of being transmitted to Bombay.

From Captain Richmond, Secretary to the Garden Committee, on the cultivation of the *Asparagus officinalis* at Alipore.

The thanks of the meeting were offered to Captain Richmond.

From Mr. Calder, presenting to the Society an extensive collection of samples of Mauritius sugar, collected by him while lately at that place, with accurate notes of the estates where the sugar was produced, degree of refining, mode of effecting it; and the market price of each, extending to 35 samples, in glass and tin.

The thanks of the meeting were offered to Mr. Calder for his valuable donation.

From Mr. Henly, presenting four samples of sugar manufactured by him at Barripore.

The thanks of the meeting were offered to Mr. Henly.

The President, in the name of Colonel Bazetta, presented a packet of fresh Manila Tobacco seed, the first which had been received by the Society.

The thanks of the meeting were voted to Colonel Bazetta, for this valuable present, and the packet was directed to be forwarded to Akra Farm, for the purpose of immediate experiment, and also of retaining a portion in well secured bottles, till a more favorable season for sowing it.

Mr. Ballard submitted on the part of Mr. D. W. H. Speed, a paper by that gentleman on the culture of silkworms, manufacture of silk, and expense incurred therein, with the view of pointing out the inferiority and dearth of the article at present, arising from the grower of the mulberry, rearer of the cocoons, and reeling of the silk, being wholly distinct and independent individuals. And presenting to the Society, four skeins or hanks of silk produced in his experimental factory, where the whole process, from the growing of the mulberry to the reeling of the silk, was performed by himself.

The thanks of the meeting were voted to Mr. Speed.

Messrs Willis and Earl presented selected samples of all cottons in the Liverpool market in December, 1831, with the prices of each correctly labelled thereon, for reference by the Society.

- The thanks of the meeting were offered to Messrs. Willis and Earl for this very valuable present.

Mr. De Verine, superintendant of the Society's Experimental Farm, at Akra, submitted various papers relative thereto; including a tabular statement of the cotton cultivation there from its commencement to the present period, on which to ground assurances of the best season for sowing, of the most suitable seed, soil, and mode of cultivation, with an account of the expense of raising three biggahs of *Maranta Arundinacea*, (or West India Arrow-root,) and manufacturing the same into farina; and also some observations on the storms of 31st October, and 26th March last.

Mr. De Verine also submitted several specimens of tobacco, cotton, and arrow-root, all reared at the Farm. Mr. Piddington submitted the form of a circular, which he thought if translated into the native languages would remove prejudices, and encourage the ryots to undertake the cultivation of seeds distributed by the Society.

Resolved, that Mr. Piddington be authorized to get his circular translated, and printed on common paper, for distribution.

The Secretary informed the meeting, that he had received only four parcels of silk, with corresponding sealed letters, as competing for the prizes of the Society; and that he had received no samples of sugar and cotton, nor any letters announcing their being on the way.

Resolved, that as the reception of samples of silk, cotton, and sugar was limited to 1st May last, no more samples of silk be now received; and that the competition for the cotton and sugar prizes lie postponed to the season of 1833, it being understood that the prizes for silk and tobacco will be adjudged on the 1st June next, as originally intended.

On the Burmese cotton, received by Mr. Swinton from Major Burney, Mr. Willis reports that he considers it of the same description as that received under Major Burney's previous dispatch, and considered by the Burmese as of foreign origin, with this difference that one-half of the seed when divested of the cotton is quite bald, having a smooth black, or rather brownish coloured skin, while the other half is furred all over with a green fur, very tenaciously adhering. This diversity and peculiarity in the seed, Mr. Willis considers worthy of remark, as it is not to be found in any of the North American kinds, nor in those of Pernambuco, Bourbon, the Seychelles, Tenasserim, or lower Bengal. The cotton is however separated from the seed, both from the bald and furred parts of it, with great and almost equal facility. The fibre is long, fine, and good in strength, and exceedingly suitable for the machine spinner.

Founding his estimate of its English value by the current prices of such sort of cotton in Liverpool in the month of December, 1831, Mr. Willis states this cotton would be worth in England from seven to eight *d.* per lb., at which rate a wide field would appear open to remunerate the cultivator, the merchant, and the ship's owner, if this description of cotton be found capable of having a successful cultivation in this country.



*Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of May, 1832.*

| Minimum Temperature<br>observed at sunrise. |                              | Maximum Pressure<br>observed at 9h. 30m. |                          | Max. Temp. and Dryness<br>observed at 2h. 40m. |                       | Minimum Pressure<br>observed at 4h. 0m. |                        | Observations made at<br>sunset. |        | Observations at 11½<br>P. M. in Calcutta. |                        |                        |                          |       |                       |                       |                       |      |     |     |     |      |      |     |
|---|------------------------------|--|--------------------------|--|-----------------------|---|------------------------|---------------------------------|--------|---|------------------------|------------------------|--------------------------|-------|-----------------------|-----------------------|-----------------------|------|-----|-----|-----|------|------|-----|
| Days of the<br>Month.                       | Barometre<br>reduced to 32°. | Temper.<br>of the air.                   | Depres. of<br>M.B. Ther. | Wind.  | Aspect of the<br>sky. | Barom.<br>red. to 32°.                  | Temper.<br>of the air. | Depres. of<br>M.B. Ther.        | Wind.  | Aspect of the<br>sky.                     | Barom.<br>red. to 32°. | Temper.<br>of the air. | Depres. of<br>M.B. Ther. | Wind. | Aspect of the<br>sky. | Rain Gauge,<br>No. 1. | Rain Gauge,<br>No. 2. |      |     |     |     |      |      |     |
| 1   | 29.688                       | 79.7                                     | 1.2                      | cm.  | cl.                   | 714                                     | 87.                    | 6.5                             | s. e.  | cu.                                       | 646                    | 93.                    | 12.1                     | s.    | cu.                   | 646                   | 93.3                  | 9.3  | e.  | cl. | 710 | 78.7 | 3.9  | r.  |
| 2   | 29.698                       | 79.3                                     | 1.6                      | cm.  | cl.                   | 739                                     | 86.3                   | 7.1                             | s. e.  | cu.                                       | 669                    | 91.7                   | 12.2                     | do.   | cu.                   | 708                   | 85.7                  | 8.2  | e.  | do. | 712 | 81.5 | 3.9  | r.  |
| 3   | 74.2                         | 79.                                      | 2.3                      | s.   | do.                   | 739                                     | 86.3                   | 9.                              | s. e.  | cl.                                       | 717                    | 90.7                   | 11.5                     | do.   | cu.                   | 654                   | 89.5                  | 12.  | do. | cu. | 711 | 84.5 | 9.6  | do. |
| 4   | 702                          | 79.3                                     | 2.4                      | s.   | do.                   | 735                                     | 89.                    | 9.5                             | s.     | cu.                                       | 693                    | 91.                    | 12.5                     | do.   | cu.                   | 650                   | 88.3                  | 9.0  | do. | cu. | 665 | 79.3 | 9.8  | do. |
| 5   | 621                          | 78.                                      | 3.3                      | e.   | do.                   | 662                                     | 88.3                   | 8.8                             | s.     | do.                                       | 585                    | 90.7                   | 9.8                      | do.   | do.                   | 571                   | 87.3                  | 8.   | do. | do. | 557 | 86.5 | 7.   | do. |
| 6   | 621                          | 78.                                      | 3.3                      | e.   | do.                   | 678                                     | 85.7                   | 7.8                             | s.     | do.                                       | 578                    | 90.7                   | 11.                      | s.    | do.                   | 587                   | 89.                   | 8.5  | s.  | do. | 590 | 85.5 | 6.3  | s.  |
| 7   | 608                          | 81.3                                     | 3.4                      | e.   | do.                   | 687                                     | 86.7                   | 9.0                             | s.     | do.                                       | 616                    | 91.3                   | 9.5                      | s.    | do.                   | 637                   | 89.                   | 8.1  | s.  | do. | 650 | 86.5 | 7.4  | do. |
| 8   | 608                          | 81.3                                     | 3.4                      | e.   | do.                   | 723                                     | 89.3                   | 8.5                             | s. w.  | cl.                                       | 604                    | 92.7                   | 12.                      | do.   | do.                   | 698                   | 91.3                  | 11.  | do. | do. | 708 | 86.5 | 8.7  | s.  |
| 9   | 712                          | 79.                                      | 1.3                      | s.   | do.                   | 723                                     | 89.3                   | 8.5                             | s.     | cu.                                       | 710                    | 91.                    | 14.5                     | do.   | do.                   | 698                   | 91.3                  | 11.  | do. | do. | 708 | 86.5 | 8.7  | s.  |
| 10  | 712                          | 79.                                      | 1.3                      | s.   | do.                   | 723                                     | 89.3                   | 8.5                             | s.     | cu.                                       | 710                    | 91.                    | 14.5                     | do.   | do.                   | 698                   | 91.3                  | 11.  | do. | do. | 708 | 86.5 | 8.7  | s.  |
| 11  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 721                                     | 89.5                   | 7.6                             | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 12  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 719                                     | 90.5                   | 11.3                            | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 13  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 719                                     | 90.5                   | 11.3                            | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 14  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 719                                     | 90.5                   | 11.3                            | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 15  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 719                                     | 90.5                   | 11.3                            | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 16  | 672                          | 80.3                                     | 2.3                      | cm.  | cl.                   | 719                                     | 90.5                   | 11.3                            | s.     | do.                                       | 696                    | 93.5                   | 15.5                     | do.   | do.                   | 651                   | 93.7                  | 12.2 | s.  | cu. | 697 | 87.5 | 7.6  | s.  |
| 17  | 740                          | 80.5                                     | 1.8                      | s.   | cl.                   | 802                                     | 86.3                   | 7.3                             | n. e.  | do.                                       | 700                    | 91.3                   | 13.4                     | n. w. | cl.                   | 680                   | 96.                   | 16.5 | s.  | cl. | 673 | 86.7 | 10.0 | do. |
| 18  | 730                          | 79.5                                     | 2.1                      | cm.  | cl.                   | 747                                     | 92.3                   | 15.3                            | s. w.  | cl.                                       | 665                    | 99.3                   | 20.6                     | do.   | do.                   | 635                   | 98.3                  | 15.5 | do. | do. | 657 | 86.5 | 11.6 | do. |
| 19  | 725                          | 80.7                                     | 2.1                      | cm.  | do.                   | 739                                     | 90.                    | 8.8                             | s. w.  | cl.                                       | 665                    | 97.                    | 14.5                     | do.   | do.                   | 647                   | 96.5                  | 15.5 | do. | do. | 657 | 86.5 | 7.3  | do. |
| 20  | 725                          | 80.7                                     | 2.1                      | cm.  | cl.                   | 770                                     | 89.3                   | 7.8                             | s. cu. | do.                                       | 687                    | 93.3                   | 7.2                      | do.   | do.                   | 660                   | 97.                   | 12.  | do. | do. | 671 | 86.3 | 6.3  | do. |
| 21  | 723                          | 81.3                                     | 1.8                      | s. w.  | cl.                   | 767                                     | 95.3                   | 5.8                             | s. w.  | do.                                       | 682                    | 96.7                   | 7.5                      | do.   | do.                   | 669                   | 95.3                  | 8.2  | do. | do. | 692 | 81.3 | 4.3  | do. |
| 22  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 23  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 24  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 25  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 26  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 27  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 28  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 29  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 30  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| 31  | 684                          | 79.5                                     | 1.3                      | cm.  | cl.                   | 721                                     | 91.7                   | 9.7                             | s. w.  | cl.                                       | 641                    | 91.3                   | 21.8                     | do.   | do.                   | 562                   | 100.3                 | 27.1 | do. | cl. | 620 | 91.  | 15.5 | do. |
| Mean,                                       | 29.684                       | 79.5                                     | 2.1                      |  |                       | 716                                     | 89.9                   | 9.6                             |        |   | 626                    | 90.9                   | 16.9                     |       |                       | 604                   | 94.6                  | 15.2 |     |     | 620 | 87.6 | 9.   |     |

Abbreviations. In the column "wind," small letters have been used instead of full names: *cu.* means cumulus; *cm.* means cirrus; *cl.* means cirro-stratus; *cs.* means cirro-stratus; *cs.* means cirro-stratus; *cs.* means cirro-stratus; *n.* means nimbus.

In the column "aspect of the sky," *cy.* is cloudy; *cl.* clearing; *br.* is rain; *dr.* is drizzle; *st.* is storm; *th.* is thunder; *li.* is lightning; *bc.* is black cloud;

*Abbreviations.* In the column "wind," small letters have been used instead of capitals: *cm.* means calm. In the column "aspect of the sky," *cy.* is cloudy; *cl.* clear; *n.* rain; *ci.* cirrus; *cu.* cumulus; *cs.* cirro-stratus; *cc.* cumulo-stratus; *cc.* cirro-cumulus; *j.* in numbers.

# JOURNAL

OF

## THE ASIATIC SOCIETY.

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. No. 6.—June, 1832.

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I.—*Analysis of the Purānas.* By H. H. Wilson, Sec. As. Soc.

[Read at the Meetings of the Society.]

### 2. THE BRAHMĀ VAIVERTTA PURĀNA.

The *Brahmā Vaivertta Purāna* is perhaps the most decidedly sectarian work of the whole collection, and has no other object than to recommend faith in KRISHNA and RĀDHĀ : subservient to this purpose, it records a great variety of legends, of which no traces can be found, in any of the other *Purānas*, and it deals but sparingly in those which are common to all. It is of little value as a collateral authority, therefore, and most of the stories, it contains, are too insipid and absurd to deserve investigation. It contains, however, a few remarkable passages, that bear an ancient character, and it throws more light than any similar work upon the worship of the female principle or *Prakriti*, as well as of KRISHNA and RĀDHĀ.

The *Brahma Vaivertta* is supposed to be communicated by SAUTI, the son of SU'TA, the original narrator of the *Purānas*, to SAUNAKA, a sage, at an assembly of similar characters, at the forest of *Naimisha*, whom he happens to visit, and who ask him to relate the work. This commencement opens several of the *Purānas*, and more especially the *Māhātmyas* or chapters, descriptive of the virtues of some place or person, said to be taken from some *Purāna*. In this case, the *Rishis* state, as the motive of their inquiry, their dread of the evil tendency of the present age, and their desire for emancipation ; and their hope to be secured in the one, and defended from the other, by being imbued with *Bhakti*, or faith in HARI, through the medium of the *Purāna*, which they style the essence of the *Purānas*, the source of faith, feli-

city, and final liberation, and the dissipator of the errors of the *Purānas*, and the *Upapurānas*, and even of the *Vedas* !

SAUTI acquired his knowledge of this work from VYĀSA, by whom it was arranged in its present form, to the extent of eighteen thousand *Slokas*. VYĀSA received the *Sutra*, the thread or outline of it, from NĀREDA, who had learnt it from NĀRĀYANA *Rishi*, the son of D'HERMA, to whom it had been communicated by his father. D'HERMA had been made acquainted with it by BRAHMĀ, who had been taught it by KRISHNA himself, in his peculiar and deathless sphere, the celestial *Goloka* :—a paradise, it may be observed, of which no trace occurs in any other *Purāna*. The *Brahma Vāivertta* is so named, because it records the manifestations of the Supreme Being in worldly forms, by the interposition of KRISHNA, who is himself the Supreme Spirit, the *Parabrahma* or *Paramātmā*, from whom *Prakṛiti*, BRAHMĀ, VISHNU, SIVA, and the rest proceeded.

The *Brahma Vāivertta Purāna* is divided into four books or *K'handas*, the *Brahmā K'handā*, the *Prakṛiti K'handā*, the *Ganeś'a K'handā*, and the *Krishna Janma K'handā*, treating separately of the nature and acts of the supreme ; of the female personification of matter ; of the birth and adventures of *Ganeś'a* ; and of the birth and actions of *Krishna*. We shall notice the principal subjects of each division.

The *Brahma K'handā* begins with the creation of the universe, as taking place after an interval of universal destruction. The world is described as waste and void, but the Supreme KRISHNA, the sole existent and eternal Being, is supposed to be present, in the centre of a luminous sphere of immeasurable extent, and inconceivable splendor. From him the three qualities, crude matter, individuality, and the elements proceed ; also NĀRĀYANA or the four-armed VISHNU, in his ordinary garb and decorations, and SANKARA, smeared with ashes, and armed with a trident. NĀRĀYANA or VISHNU comes from the right, and SIVA from the left side of the primeval KRISHNA, and BRAHMĀ springs from his navel : all the gods and goddesses in like manner proceed from his person, and each upon his or her birth utters a short prayer or hymn in honour of him : the following are the salutations of the three principal persons of the *Hindu* pantheon.

NĀRĀYANA's address to KRISHNA.

“ I pay reverence to the cause of causes, to him who is at once the act and the object, the superior boon, the giver and meriter, and source of blessings ; who is religious austerity, and its everlasting fruit, and himself the eternal ascetic ; who is beautiful, black as a new cloud ; delighted in his

own spirit ; who is void of desire, who assumes forms at will, who annihilates the five desires, and who is the cause of desire ; who is all things, the lord of all things, and the unsurpassed form, which is the seed of all things ; who is embodied in the *Vedas*, who is the seed of them, the fruit of the *Vedas*, and its bestower ; who is learned in the *Vedas*, the ritual they enjoin, and the best of all who are conversant with their doctrines."

SIVA'S address.

"I adore him, the invincible, the giver, the lord and cause of victory, the best of the bestowers of victory, and victory itself ; who is the lord and cause of all things, lord of the lord of all things, and cause of the cause of all things ; who is present in all, who upholds all, who destroys all, generates all, who is the cause of the preservation of all, who is all things ; who is the fruit, the giver of the fruit, its seed, and its support ; who is identical with light, the irradiator of all, and supreme of all those who shine with divine radiance."

BRAHMA'S address.

"I adore KRISHNA, who is free from the three qualities, the one imperishable GOVINDA, who is invisible and void of form, who is visible and assumed the shape of a cowherd, who seems a youth in years, who is of mild deportment, the beloved of the *Gopis*, of lovely aspect, black as a new cloud, and beautiful as a myriad of KANDERPAS. Inhabiting the place of the *Rāsa* in his sojourn in the groves of *Vrindavan*, the lord of the mystic dance, and its performer, and the delighter in the graces of its evolutions."

The other divinities continue in the same strain, and the tendency of the hymns furnishes a key to the whole work, the object of which is to identify the cowherd of *Vrindavan*, with the supreme cause of the world, or to claim for KRISHNA a rank which the followers of VISHNU and SIVA demand, exclusively, for the object of their respective adoration : with much more reason it must be confessed ; for the actions of KRISHNA are even still more preposterously incompatible with a divine character than those of his competitors for pre-eminence.

After the several deities are produced from various parts of KRISHNA'S person, he retires into the *Rāsamandala*, a chamber or stage for the performance of a kind of dance, to which the followers of this divinity attach much importance, although it seems to be no more than a kind of dramatic representation of KRISHNA'S dancing and sporting with the *Gopis*. There, RĀDHĀ, his favourite mistress, proceeds from his heart ; from the pores of her skin spring three hundred millions of *Gopis*, or nymphs of *Vrindavan* ; and an equal

number of *Gopas*, the swains of the preceding, originate from the pores of KRISHNA's skin ; the herds they are to attend owe their existence to the same inexhaustible source. The *Rāsa* and *Rādhā*, and the origin of the kine, and their keepers, male or female, are amongst the chief characteristic peculiarities of the *Brahma Vairertha Purāna*.

After KRISHNA's thus evolving the different orders of subordinate deities, the work proceeds to describe the devotion of SIVA towards his creator, and takes this opportunity of expatiating upon the different degrees of *Bhakti*, or faith, and the various kinds of *Mukti*, or salvation.

The work of creation is then resumed by BRAHMÁ, who begets by his wife SÁVITRĪ, a various and odd progeny, as, the science of logic, the modes of music, days, years, and ages, religious rites, diseases, time, and death. He has also an independent offspring of his own, or VISWAKERMÁ, from his navel ; the sage SÁNANDA, and his three brothers, from his heart ; the eleven *Ru'dras* from his forehead, and sundry sages from his ears, mouth, &c.

The legends that follow relating to the daughters of DHARMA, and their marriages with various patriarchs, from whom terrestrial objects proceeded, are told in the usual strain. In describing the origin of the mixed classes of mankind, this work contains a peculiar legend, which makes a certain number of them, the issue of the divine architect VISWAKERMÁ by GHRIĀCHĪ, a nymph of heaven. The chapter often occurs as a separate treatise under the title of *Jāti Nirṇaya*, and is considered as an authority of some weight, with respect to the descent of the mixed tribes, although of a purely legendary character.

The succeeding sections contain some legends of little importance, until the 16th, which is occupied with a short, but curious list of medical writers and writings. The first work on medical science entitled the *A'yur Veda* was, like the other *Vedas*, the work of BRAHMÁ, but he gave it to *Sūrya*, the sun, who, like the *Phæbus* of the Greeks, is the fountain of medical knowledge amongst the *Hindus*. He had sixteen scholars, to each of whom a *Sanhitá* or compendium is ascribed : none of the works attributed to them are now to be procured.

The chapters that next follow, relate a legendary story of the wife of a *Gandherva* named MĀLAVATĪ, the efficacy of various *Mantras*, the story of NĀREDA, the sage, and rules for the performance of daily purificatory and religious rites. The 28th and 29th chapters, the last of the book, are occupied with the description of KRISHNA, of his

peculiar heaven or *Goloka*, of the holy *Rishi* NÁRÁYANA, and of his residence. The style and purport of the whole are peculiar to this *Purāna*, and similar to the address of the deities, cited above. *Goloka* is said to be situated 500 millions of *Yojanas* above the *Lokas* of SIVA and VISHNU. It is a sphere of light, tenanted by *Gopas*, *Gopis*, and cows; the only human persons admissible to its delights are pure *Vaishnavas*, the faithful votaries of KRISHNA. It appears, however, that the author of this *Purāna*, who in all probability is the inventor of *Goloka*, had no very precise notions of his own work, as he calls it in one place square, and in another round; and whilst he is content in one passage to give it the moderate diameter of 30 millions of *Yojanas*, he extends its circumference in another to a thousand millions.

The next section of this *Purāna*, is also of a peculiar character. It relates to *Prakriti*, the passive agent in creation, personified matter, or the goddess nature. The *Purānas*, in general, follow in regard to their cosmogony the *Sāṅkhya* school of philosophy, in which *Prakriti* is thus described: *Prakriti* or *Mūla Prakriti* is the root or plastic origin of all, termed *Pradhāna*, the chief one, the universal material cause. It is eternal matter, undiscete, undistinguishable as destitute of parts, inferrible from its effects, being productive, but no production.

According to the same system, the soul is termed *Purush* or *Pitṛmān*, which means man or male; but the *Sāṅkhya* doctrine is twofold, one atheistical, the other theistical. The former defines the soul to be neither produced nor productive, not operating upon matter, but independent and co-existent; the latter identifies soul with *Iṣwara*, or God, who is infinite and eternal, and who rules over the world; and it is to this latter system, that the *Purānas* appertain, only in this *Iṣwara* they recognise the peculiar object of their devotion, whichever of the *Hindú* triad that may be, or even as in the work before us, superadding a fourth in KRISHNA, who is every where else regarded but as a manifestation of VISHNU, and in a remarkable passage of the *Mahābhārat* is said to be no more than an *Avatār* of a hair plucked from the head of that divinity.

In the true spirit of mythology, which is fully as much poetical as religious, the figure of prosopopeia is carried by the Hindus to its utmost verge; and we need not wonder therefore to find spirit and matter converted by the *Paurānic* bards into male and female personifications, with the attributes adapted to either sex, or derived from the original source of either representation. *Prakriti* is consequently held to be not only the

productive agent in the creation of the world, but she is regarded as *Māyā*, the goddess of delusion, the suggester of that mistaken estimate of human existence, which is referable to the gross perceptions of our elementary construction. With this character the *Paurāṇics* have combined another, and confounding the instrument with the action, matter with the impulse by which it was animated, they have chosen to consider *Prakṛiti* also as the embodied manifestation of the divine will, as the act of creation, or the inherent power of creating, co-existing with the supreme. This seems to be the ruling idea in the *Brahma Vaiṣṇava*, in which the meaning of the word *Prakṛiti*, and the origin of this agent in creation, are thus explained :—

“The prefix *Pra* means pre-eminent, *Kṛiti* means creating ; that goddess who was pre-eminent in creation, is termed *Prakṛiti* : again, *Pra* means best, or is equivalent to the term *Satwa*, the quality of purity, *Kṛi* implies middling, the quality of passion, and *Ti* means worse or that of ignorance. She who is invested with all power is identifiable with the three properties, and is the principal in creation, and is therefore termed *Prakṛiti*. *Pra* also signifies first or foremost, and *Kṛiti* creation ; she who was the beginning of creation, is called *Prakṛiti*.”

“The supreme spirit in the act of creation became by *Yoga* two-fold, the right side was male, the left was *Prakṛiti*. She is of one form with *Brahmā*. She is *Māyā*, eternal and imperishable. Such as the spirit, such is the inherent energy (the *Sākti*), as the faculty of burning is inherent in fire.”

The idea of personifying the divine agency, being once conceived, was extended by an obvious analogy to similar cases, and the persons of the *Hindū* triad, being equally susceptible of active energies, their energies were embodied as their respective *Prakṛitis*, *Saktis*, or goddesses. From them the like accompaniment was conferred upon the whole pantheon, and finally upon man ; women being regarded as portions of the primeval *Prakṛiti*. The whole being evidently a clumsy attempt to graft the distinction of the sexes as prevailing in earth, hell, and heaven, upon a metaphysical theory of the origin of the universe.

The primeval *Prakṛiti*, according to our authority, which now becomes wholly mythological, resolved herself, by command of KRISHNA, into five primitive portions. These were DURGĀ, the *Sakti* of MAHĀDEVĀ ; LAKSHMI, the *Sakti* of VIṢṆU ; SARASWATĪ the goddess of language ; SĀVITRĪ, the mother of the *Vedas*, and RĀDHĀ, the favourite of KRISHNA.

In the same manner as the primary creator of the world multiplies his appearances, and without losing any of his individual substance, occupies by various emanations from it different frames; so the radical *Prakṛiti* exists in different shapes, and in various proportions, distinguished as *Anśas*, portions, *Kaṣas*, divisions, and *Kaṭīnśas* and *Anśānśas*, or subdivisions, or portions of portions. Thus *Gaṅgā*, *Tulasi*, *Manasā*, *Shashṭ'hī*, and *Kālī*, are *Anśarūpas*, or forms having a portion of the original *Prakṛiti*; *Swāhā*, *Swadhā*, *Dakṣiṇā*, *Swastī*, a host of virtues and vices, excellences and defects, and all the wives of the inferior deities are *Kaṭārūpas*, forms constituted of a minor division of *Prakṛiti*; whilst all the female race are animated by her minuter portions, or subdivisions, and they are virtuous or vicious, according as the quality of goodness, passion, or ignorance, derived from their great original, predominates, in the portion of which they are respectively constituted. Women who go astray, therefore, have by this system, a better excuse than the stars.

The compiler of this *Purāna* is very little scrupulous as to the consistency of his narrative, and assigns to the principal goddesses other origins than that which he gives in the beginning of the *Brahmā Kṛhanda*, or in the first chapter of this section. Thus *SARASWATĪ*, who came out from the mouth of *KRISHNA* in the former, and in the latter, is said to be one of the five subdivisions of *Prakṛiti*, is now described as proceeding from the tongue of *RĀDHĪKĀ*; and *LAKSHMĪ*, who in one place is also a portion of *Prakṛiti*, and in another issues from the mind of *KRISHNA*, is described in this part of the work, as one of two goddesses, into which the first *SARASWATĪ* was divided; the two being *SARASWATĪ* proper, and *KAMALĀ* or *LAKSHMĪ*. These incoherencies are quite characteristic of this *Purāna*, which from first to last is full of contradictory repetitions, as if the writer was determined to make a large book out of a few ideas, the precise nature of which he forgot as fast as he committed them to paper.

After this account of the origin of the principal female forms, the third chapter contains a more particular description of the sphere of *KRISHNA* or *Goloka*. It then repeats an account of the creation of the world, through the agency of *BRAHMĀ*; and the following chapters of the section, are devoted to legendary stories of the principal *Prakṛitis*, or *SARASWATĪ*, *GANGĀ*, *TULASI*, *SĀVITRĪ*, *LAKSHMĪ*, *SWĀHĀ*, *SWADHĀ*, *DAKSHINĀ*, *SHASHṬ'HĪ*, *MANGALĀ*, *CHANDĪ*, *MANASĀ*, *SURABHĪ*, *RĀDHĪKĀ* and *DURGĀ*. In the course of these narratives various others are introduced, illustrative of the characters of gods, saints, heroes, and heroines, all tending to show the fervour with which



they worshipped KRISHNA. Accounts of *Goloka*, a description of hell, and an explanation of the chronological system of the *Purānas*, are interwoven ; besides other subjects of a peculiar and legendary nature, conveying little information or amusement.

The third section of the *Brahma Vaivertta Purāna* is the *Ganes'a K'handa*, giving an account of the birth and actions of that deity, in a series of legends, which are not of frequent occurrence, and are in a great degree, if not altogether, peculiar to the work.

PÁRVATI after her marriage with SIVA, being without a child, and being desirous to obtain one, is desired by her husband to perform the *Punyaka Vrata*. This is the worship of VISHNU, to be begun on the thirteenth day of the bright fortnight of *Mágha*, and continued for a year, on every day of which, flowers, fruits, cakes, vessels, gems, gold, &c. are to be presented, and a thousand *Bráhmans* fed, and the performer of the rite is to observe most carefully a life of outward and inward purity, and to fix his mind on HARI or VISHNU. PÁRVATI having with the aid of SANATKUMÁRA, as directing priest, accomplished the ceremony on the banks of the Ganges, returns after some interval, in which she sees KRISHNA, first as a body of light, and afterwards as an old *Bráhmāna*, come to her dwelling. The reward of her religious zeal being delayed, she is plunged in grief, when a viewless voice tells her to go to her apartment where she will find a son, who is the lord of *Goloka*, or KRISHNA, that deity having assumed the semblance of her son, in recompence of her devotions.

In compliment to this occasion, all the gods came to congratulate SIVA and PÁRVATI, and were severally admitted to see the infant : amidst the splendid cohort was SANI, the planet Saturn ; who although anxious to pay his homage to the child, kept his eyes stedfastly fixed on the ground. PÁRVATI asking him the cause of this, he told her, that being immersed in meditation upon VISHNU, he had disregarded the caresses of his wife, and in resentment of his neglect, she had denounced upon him the curse that whomever he gazed upon he should destroy : to obviate the evil consequences of this imprecation he avoided looking any one in the face. PÁRVATI having heard his story paid no regard to it, but considering, that what must be, must be, gave him permission to look at her son. SANI calling DHARMA to witness his having leave, took a peep at GANE'SA, on which the child's head was severed from the body, and flew away to the heaven of KRISHNA, where it reunited with the substance of him, of whom it was part. DURGA' taking the headless trunk in her arms, cast herself, weeping

on the ground, and the gods thought it decent to imitate her example, all except VISHNU, who mounted *Garura*, and flew off to the river *Pushpubhadra*, where finding an elephant asleep he took off his head, and flying back with it, clapped it on the body of GANE'SA; hence the body of that deity is crowned with its present uncouth capital. On the restoration of GANE'SA to life, valuable gifts were made to the gods and *brāhmanas*, by the parents, and by PÁRVATI'S father, the personified *Himālaya*. The unfortunate SANI was again anathematised, and in consequence of the curse of PÁRVATI, has limped ever since.

These legends and others of minor importance, with the various prayers and addresses of the deities, occupy the first 13 chapters. The next five give an account of the birth of KARTIKEYA. In the 19th and 21st chapters the reason why GANE'SA'S head was lopped off is given. SIVA offended with ADITYA, the sun, slew him, and although he restored him to life, incurred the wrath of the sage KA'SYAPA, who doomed his (SIVA'S) son to lose his head. The elephant was INDRA'S elephant, and was decapitated because INDRA threw over his neck the garland of flowers, which the sage DURVÁSAS gave him, and the disrespect of which, with the consequent degradation of INDRA, is noticed in various *Purānas*, although in all other respects with different results. INDRA was no loser of an elephant by his decapitation, as VISHNU, moved by the prayers of his mate, gave him another head in place of that which he took away. The humiliation of INDRA, and his recovery of LAKSHMI' or glory, are the subjects of the next five chapters, and the remaining half of this section is occupied with the story of GANE'SA'S losing one of his tusks. It was broken off by PARASURÁMA, and the occurrence therefore involves his history, and that of his ancestor BHIRGU, the possession of the all-bestowing cow by JÁMADAGNI, the attempt to carry her off by the king KÁRTAVIRYA'RJUNA; the conflict that ensued, and the death of the sage; PARASURÁMA'S avenging his father's loss, by slaying KÁRTAVIRYA'RJUNA; his combats with the kings, who came to the aid of that prince; and the destruction of the military race.

After this last exploit, PARASURÁMA, who was a favourite disciple of SIVA, went to *Kailāsa* to visit his master; on arriving at the inner apartments, his entrance was opposed by GANE'SA, as his father was asleep. PARASURÁMA nevertheless urged his way, and after a long and absurd dialogue, in which devotion to KRISHNA is most abruptly and diffusely introduced, the parties came to blows. GANE'SA had at first the advantage, seizing PARASURA'MA in his trunk, and giving him

a twirl that left him sick and senseless ; on recovering, RĀMA threw his axe at GANEŚA, who recognizing it as his father's weapon (SIVA having given it to PARASURĀMA), received it with all humility upon one of his tusks, which it immediately severed, and hence GANEŚA has but one tusk, and is known by the names *Ekadanta* and *Ekadantashtra*, (the single-tusked.) PĀRVATI was highly incensed with PARASURĀMA, and was about to curse him, when KRISHNA, of whom he was the worshipper, appeared as a boy and appeased her indignation. This part of the work ends with a recapitulation of the names of GANEŚA, his quarrel with TULASI, in consequence of an imprecation from whom it was, that he lost one of his tusks ; PARASURĀMA's adoration of him, and retiring to lead an ascetic life.

The last section, the *Krishna Jonma K'handa*, is very voluminous, containing 132 chapters. It gives an account of KRISHNA's birth and adventures, as narrated by NĀRĀYAṆA to NARE'DA.

The narrative is introduced by a panegyric of the individual, who is a real *Vaishnava*, or thoroughly devoted to KRISHNA : and who consequently becomes endowed with all knowledge and virtue, acquires superhuman faculties on earth, is elevated to the region of KRISHNA after death, and liberates himself, and seven generations above and below him, from the penalty of regeneration. All crimes avoid him, or are consumed in his purity, like moths in a lamp ; and any one meeting him on the road, is thereby cleansed of the sins he may have contracted for seven preceding lives ; no course of religious practices, or devout penances is necessary to the attainment of such miraculous excellence, and the love of HARI or KRISHNA is the only condition required. He who has received the initiatory *mantra*, who repeats the name of that divinity constantly, who transfers to him every worldly desire and possession, whose thoughts ever dwell upon him in prosperity or distress, and the hair of whose body stands erect with rapture on his simply hearing any of the appellations of KRISHNA articulated, has fulfilled every obligation, and merits the designation of a *Vaishnava*.

According to this *Purāṇa*, and this only, the original cause of KRISHNA's incarnation, was his love of RĀDHĀ. The RĀDHĀ of the *Goloka* had been compelled to assume a mortal body, by the imprecation of a *Gopa* of that region, KRIDAMA, the minister of his master's pleasures, and the object of RĀDHĀ's anger. Him she condemned in a fit of jealous indignation to become the *Asura* SANKHĀCHU'RA, and he in retaliation sentenced her to become a nymph of *Vrindāvan*. To console her in this condition KRISHNA also came down to this world,

as her lover ; at the same time, however, granting the prayers of BRAHMA and the gods, who solicited his appearance to relieve the earth from the burthen of the iniquities under which she laboured, the legitimate purpose of every descent or *Avatāra*. In order to provide KRISHNA and RĀDHĀ with suitable associates, all the gods and goddesses also assumed their respective characters as *Gopas* and *Gopis*, or members of the family of YADU, and the heroes of the *Mahābhārat*. VASUDEVA, the father of KRISHNA, was an incarnation of KASYAPA, and DE'VAKI, his mother, of ADITI. NANDA was an incarnation of one of the *Vasus*, and YASODĀ of his spouse DHARĀ. DURGĀ was incarnate as the daughter of the bear JĀMBAVĀN. JAMBĀVAITI one of KRISHNA'S brides, and LAKSHMI', multiplied herself into the sixteen thousand princesses, whom KRISHNA enumerated amongst his wives.

The story of VASUDEVA and DE'VAKI, and the birth of KRISHNA are narrated in the usual manner, which gives occasion to directions for the celebration of the *Jānmāshthami*, or festival in commemoration of the birth-day of KRISHNA on the 8th lunation of the month *Srāvan*, and the *Purāna* authorises its observance agreeably to the practice of the *Sāktas*, which allows it to be independent of the moon's entering into the asterism *Rohini*, although should the position of the moon and the lunation occur together, the festival is the more holy, and is termed *Jayantī* or triumphant. The festival is on no account to commence on that day, in which a part of the 7th lunation may occur. The variety of doctrine and observance on this head is explained in the *Asiatic Researches* (vol. xvi. page 92, note.) To omit the observance altogether is a crime not to be expiated, and is equal in atrocity to the murder of a hundred *brahmins*.

The infant exploits of KRISHNA are next related, and require no particular comment. GARGA, the *Muni*, points out RĀDHĀ, the daughter of VRISHABHA'NU, as an eligible bride for the youth, and acquaints NANDA, KRISHNA'S foster father, of the secret of her divinity, in which he thus expounds her name.

“ The letter *R* preserves persons from sin, the vowel *A* obviates regeneration, *D'h* shortens the period of mortal existence, and the second long vowel sunders all worldly bonds.” The marriage was accordingly celebrated with great rejoicing, and the distribution of viands in large quantities, and the donation of immense treasures. The incompatibility of such profusion, with the condition of NANDA, the cowherd, is of no consideration to the author of this work, although it

has saved the author of the *Bhāṅgavat*, the original of the greater part of the story, from any such gross extravagancies.

The hero of the festivities, steals the curds in the next chapter, for which he is tied to a tree, and gets a whipping from his foster mother YASODĀ. After she leaves him, the tree falls, and from it emerges NĀLAKUVERA, the son of KUVĒRA, condemned to this metamorphosis, for indecent behaviour in the presence of DEVALA\* *Muni*.

A long chapter is next occupied with the praises of RĀDHĀ by KRISHNA and BRAHMĀ, which inculcate her supremacy over all other divinities, male or female, and her being inseparable from and one with KRISHNA. The sports of the juvenile god are then related, and his destruction of the demons VĀKA, KĒSI, and PRĀLAMBA; the construction of palaces at *Gokula*, for all its inhabitants, by VIŚWAKERMA, the divine architect, of whose architectural exploits, the village of *Gokula* now offers no vestiges. This part of the work comprises the history of VṚSHABHĀNU, and his wife KĀLĀVATĪ, the parents of RĀDHĀ, and who were rewarded by her birth, for the virtues of their former existence, as SUCHĀNDRA, a king of the family of MENU, and KĀLĀVATĪ, a will-born daughter of the *Pitris* or progenitors of mankind. This story includes a dissertation upon the virtues of women.

Several chapters follow, partly describing the actions of KRISHNA, and partly expatiating upon his excellencies and those of RĀDHĀ.

A legend of SĀHASIKA, the son of the son of BALI, follows, who was turned into an ass, by the curse of DURVĀSAS, for having disturbed the meditation of that sage, in the prosecution of his amours with TĪLOTAMĀ, a nymph of heaven. On the penitence of the couple, DURVĀSAS announced to them, that the ass should be destroyed by the discus of KRISHNA, in consequence of which, the spirit of SĀHASIKA should receive final emancipation, and that TĪLOTAMĀ should be born the daughter of BĀNĀSURA, in which capacity, she should become the bride of ANIRUDDHA, the grandson of KRISHNA.

The marriage of DURVĀSAS with KADĀLI, the daughter of AURVA *Muni*, is the next legend; in this, the violent temper of his wife excites the sage's wrath, and he reduces her to ashes. Repenting subsequently of his anger, and soothed by the appearance of BRAHMĀ, he changes the remains of his wife into a plantain tree. The same sage is the subject of another legend of great celebrity amongst the *Vaishnavas*, as illustrating KRISHNA's superiority over SIVA. DURVĀSAS, a votary of that deity, being offended with AMBARĪŚHA a devout worshipper of VIŚHNU, attempted to destroy him, but was repelled, and narrowly

\* One place has Galava.

escaped destruction himself by the *Chakra* or discus of *VISHNU*, which came to the assistance of the king. The merits of fasting on the eleventh day of the fortnight, are the subject of the next chapter, and they are followed by an explanation of the eight names of *DURGÁ*, which again is relieved by a story of *KRISHNA*, carrying away and hiding the clothes of the nymphs of *Gokula*, whilst they were bathing in the *Jumna*. He gives up his booty upon being prayed to by *RÁDHÁ*, in the usual strain, culogising his divine supremacy, and identification with all things known or unknown. Several legends of minor importance follow, to the 32nd chapter, when that, and the two following, are occupied with the advances made by *MOHINI*, a heavenly nymph to *BRAHMÁ*, and his insensibility, in resentment of which she curses him, that he shall not receive any adoration from mankind; the effects of which malediction are said to be evinced in the neglect which *BRAHMÁ* experienced from the professors of the *Hindú* faith.

The attention of the work is next directed, through a series of chapters, to the legends of the *Saiva* faith, or *BRAHMÁ*'s discomfiture by *SIVA*, the asceticism of the latter, his marriage with *SATI*, the daughter of *DAKSHA*, her burning herself, and *SIVA*'s second marriage with *PÁRVATI* the daughter of *HIMÁLAYA*. Stories of *VRISHASPATI*, *INDRA*, *VAHNI*, *DURVÁSAS*, and *DIANWANTARI* then follow. All these legends are supposed to be narrated by *KRISHNA* to *RÁDHÁ*, for her entertainment; and their general purport is to shew, that the personages to whom they refer, are immeasurably inferior to *KRISHNA*, and his votaries.

Some cases are then recorded of the humiliation of the leading personages of the *Hindú* Pantheon, in consequence of their incurring the displeasure of *KRISHNA* or some of his followers. *VISHNU*, whilst boasting himself the god of all, was swallowed by *KRISHNA* in the form of a *Bhairava*, all but his head, and was restored to his form, on recovering his senses. *BRAHMÁ*, whilst making a similar vaunt, was surprised to behold multitudes of *Brahmas* and *Brahmandas*, or creations distinct from himself and his works; and *SIVA* was condemned to pay the penalty of his pride, by his marriage with *SATI*, and distraction for her loss, which were the delusions of *KRISHNA*.

The 62nd chapter contains a summary account of *RÁMACHANDRA*, and the next ten proceed with an account of the transactions that immediately preceded *KRISHNA*'s departure from *Vrindávan* for *Mathura*, whether he was attracted, with his supposed father *NANDA*, by a special invitation from *KANSÁ*, his uncle, with a view to his destruction, at a sacrifice offered to *SIVA*. The result of this visit is the death of *KANSÁ*, as described in other *Puránas*; but there is no detail of the

previous wrestling, which occurs in the *Bhāgavat*. On taking final leave of his foster father NĀNDA, KRISHNA favours him with a code of regulations, for his moral and religious conduct: he is not to look at a single star, nor the setting sun or moon; not to keep company with the wicked, nor to injure or insult *Brāhmins*, cows, and *Vaiṣṇavas*; not to delay payment of the due fees to the priest who officiates at a ceremony; not to eat flesh or fish; not to vilify SIVA, DURGA, or GANAPATI; and on no account to omit every possible demonstration of his love for HARI. These injunctions extend to a great length, and are all of as little importance as the above. There are some curious denunciations, however, against acts which are lawful in the institutes of MENU; and no distinction is here made between a *Brāhman* who follows the profession of arms, and one who marries a woman of the *Sūdra* caste. There is also a singular leaning shown to the *Saiva* faith, and the man who forms a single *Siva-linga* of clay, is said to reside in heaven for 100 *Kalpas*. The following scale is given of KRISHNA'S affections: "Of all tribes the *Brāhman* is most esteemed by me, LAKSHMI' is still more beloved than a *Brāhman*, RĀDHĀ is dearer to me than LAKSHMI', a faithful worshipper is dearer than RĀDHĀ, and SANKARA is the best beloved of all." The instructions to NĀNDA comprise also a dissertation upon dreams, upon knowledge of the divine nature, and on the duties of the different castes and orders of the *Hindūs*, on the duties of women, and the expiation of offences. This division of the work extends from the 75th to the 85th chapter.

A legend of the birth of VRINDĀ, the daughter of KEDĀRA, next follows: from her, *Vrindāvan*, or as usually termed *Bindrāban*, derives its appellation, she being identified with RĀDHĀ in her birth at that place. This chapter is followed by several others of a very miscellaneous character, in which BRAHMĀ, SIVA, and the *Munis* eulogise KRISHNA'S power. The next sections are occupied with the mission of UDDHAVA from KRISHNA to *Gokula*, to bear intelligence of the latter to his parents and his mistresses; and we have then a short detail of the usual *Paurānik* chronology: UDDHAVA returns to KRISHNA, and we have then a narrative of KRISHNA'S being invested with the thread of his tribe; he then prosecutes his studies under SANDI'PANI *Muni*, and at their close relinquishes the garb of a cowherd for the robes of a king, presenting to his *Guru* four lacs of diamonds, an equal number of other sorts of gems, five lacs of pearls, a necklace worn by DURGA, dresses worth all the treasures of the world, and ten crores of *Suvarnās*, or certain measures of gold:—puerile exaggerations, which although not

unknown to the other *Purānas*, are most lavishly multiplied in the work under review.

• Although assuming a royal character, this work describes KRISHNA as resigning the supremacy to UGRASE'NA, and directing *Dwārakā* to be built for him, by the divine architect VISWASE'NA—a wide departure from the account every where else given of the circumstances, under which *Dwārakā* became the capital of KRISHNA. He having been driven from *Mathurā* by JARĀSANDHA, the father-in-law of KANSA, whom KRISHNA had deposed and slain; KRISHNA and his tribe, on their expulsion from *Mathurā*, fled to the west coast of the peninsula, and there founded a new city. No notice whatever is taken of these revolutions in this work, although they are told at some length, in the *Mahābhārat*, *Vishnu Purāna*, and *Bhāgavat*. In a subsequent chapter indeed, this *Purāna* refers to the same events, although it does not particularise them; and RUKMI the brother of RUKMINI' reproaches KRISHNA with having fled to *Dwārakā* through fear of JARĀSANDHA.

KRISHNA's marriage with RUKMINI' is next narrated, but he does not carry her off, as in other authorities. Her brother opposes his entrance into the city, but is defeated by BALADEVA, and then KRISHNA enters, and is duly married to the princess in her father's presence. Every where else, he runs away with her before the marriage, and BALADEVA checks the pursuit.

In the next chapters, a conversation between RĀDHĀ and YASODĀ, expounds the purport of eleven names of KRISHNA, and these are succeeded by an account of the birth of RUKMINI's son PRADYUMNA, his being carried off by a demon, and his recovery, the birth of other sons of KRISHNA, and marriage of the sage DURVĀSA to a daughter of UGRASE'NA. KRISHNA's share in the war of the *Mahābhārat* is very briefly dispatched, except a long hymn to him by SISUPĀLA, whom he slew. The intrigue of ANIRUDDHA, KRISHNA's grandson, with USHĀ, the daughter of VĀNA, is narrated at some length, in the usual style, and the unsuccessful contest waged by that prince against KRISHNA is protracted by the episodical insertion of a variety of stale legends, to a disproportionate extent; these stories are related alternately by ANIRUDDHA and VĀNA, as they stand prepared to engage in single combat for the purpose of proclaiming the respective might of KRISHNA and SIVA, VĀNA being devoted to the worship of the latter divinity. SIVA however, after vainly attempting to dissuade him from the conflict, is obliged to witness his votary's defeat, with that of SKANDA



and BHADRAKĀLI, who had gone to his succour ; and VĀNA becoming sensible of KRISHNA's supremacy, consents to his daughter's union with ANIRUDDHA.

The next chapters relate to the origin of the *Bindusāra Tirtha*, from the tears of KRISHNA ; the reason why it is sinful to look at the moon on the 4th day of *Bhādra*, and SATRAJIT's obtaining that gem, whose presence in a country insures its fertility. The adoration of GANE'SA by RĀDHĀ, in the presence of the assembled deities, is the subject of the 122nd and 123rd chapters, and as acknowledged in the text, is one rarely treated of in other *Purānas*. GANE'SA, not to be outdone, eulogises RĀDHĀ in his turn, and is followed by BRAHMĀ and ANANTA. The worship of GANE'SA by RĀDHĀ marked the termination of the curse, which had sentenced her to a mortal existence ; and she was then restored to her celestial nature, in which DURGĀ is made to declare that there is no difference between RĀDHĀ and herself, and whoever speaks in a depreciating manner of either, is equally punished in hell.

KRISHNA, having also offered worship to GANE'SA, returns to *Dwārakā*, and resumes his lessons to NANDA and his family ; he also prophesies the depravity of the world in the succeeding or *Kali* age, in which men will abstain from venerating *Sūlagrām* stones and *Tulasi* plants, and attach themselves assiduously to the service of *Mlechhas*, barbarians and outcastes, who it is said also, shall become the rulers of the country :—expressions indicative of the prevalence of the *Mohammedan* authority, when the *Purāna* was compiled.

RĀDHĀ after this returns to *Goloka*, with all the *Gopas* and *Gopīs* of divine origin, KRISHNA creating others to supply their place at *Vrīndāvan*. The circumstances of KRISHNA's death, by a wound from a hunter, the destruction of his tribe, and the submersion of *Dwārakā* by the sea, are next alluded to, in so brief and obscure a manner, that without a previous knowledge of what is intended the notice would be quite unintelligible ; and these events are lost sight of amidst the much more detailed addresses of the gods and goddesses, the ocean, the rivers, and particularly the Ganges, in which the sufferings of the earth, in consequence of KRISHNA's departure, are most pathetically lamented. After KRISHNA's death, the form that proceeded from his person, went to the *Sveta Dwīpa*, where it became two : one-half was NĀRĀYANA, the lord of *Vaikuntha* ; the other was KRISHNA, the deity of *Goloka*, the supreme indescribable source of all, who ascended to his original seat, and was reunited to RĀDHĀ.

The *Purāna* properly closes here, at the end of the 128th chapter ; but NÁREDA, who has been its auditor, now hears from the narrator NÁRÁYANA, that he, NÁREDA, was in his former life, a *Gandharva*, the husband of 50 wives, one of whom is reborn, as well as himself, and by the boon of SIVA, is to be once more his bride. NÁREDA submits rather reluctantly, and shortly after his marriage with the daughter of SRINJAYA, who is declared to be one with MÁYÁ, run away from his wife to perform penance, through which he is united with HARI.

A supplementary chapter, the 130th, follows, in which SU'TA, the ordinary narrator or recapitulator of the *Purānas*, relates two legends, explaining the birth of Fire from BRAHMA, and of gold from Fire. Chapter 131 is a short index to the *Purānas*. The last chapter, 132, enumerates the different *Parānas* and *Upapurānas*, the five works called *Pancharātra*, and the five *Sanhitas* or compendia of the *Vaishnava* faith. It is also remarkable for its definition of the *Mahābhārat*, and the *Rāmāyana*, the former of which it terms a *Itihāsa*, or history, and the latter a *Kāvya*, or poem : the work terminates with a eulogium on itself ; the attentively hearing of one quarter of a verse of which, is equal in merit to the gift of the heaven of KRISHNA.

The preceding sketch of the contents and character of this work will probably have furnished sufficient evidence of its modern origin. It is clearly subsequent to the great body of *Hindú* literature, not only by the enumeration just noticed, but by reference to the several philosophical systems, the *Terka*, *Vaisheshika*, *Sāṅkhya*, *Pātanjala*, *Memāṃsa*, and *Vedānta*, which occurs in a preceding passage. Its being the latest of the *Purānas* is also apparent from its own avowal of its being intended to clear up the discrepancies observable in those works, and by the frequent assertion, that the legends it gives, particularly those respecting GANE'SA, are not to be met with in the other *Purānas*. That it was compiled subsequent to the *Mohammedan* invasion, is very probable, from the allusions it contains to the supremacy of *Mlechha* rulers ; and the particular branch of the *Hindú* system which it advocates, renders it likely to have emanated from a sect, which there is reason to imagine originated about four centuries ago with VALLA-LECHÁRYA and the *Gosains* of *Gokula*.

**II.—Some observations on the Quantity of Earthy Matter brought down by the Ganges River. By the Rev. R. Everest.**

[Read before the Physical Class, 13th June, 1832.]

In the course of last summer, I made some attempts to ascertain the weight of solid matter contained in a given quantity of Ganges water, both in the dry and rainy season, but I found the weight so variable on different days (when little difference might have been expected) that I can hardly consider the observations numerous enough to give a correct average. Such as they are, however, they may not be without interest in the absence of other information on the subject. I therefore take the liberty of laying them before the Society, and shall, if opportunity offers, endeavour to add some further data, both for the weight of solid matter, and also for the rise and velocity of the river.

1. A quantity of Ganges' water taken 27th May, 1831, gave when evaporated, a solid residuum of 1.084 grains per wine quart.

2. July 21st. There had been little rain for some days, and the river was low for the season: a wine quart contained of soluble matter 2.0 grains; of insoluble, 16.2;—total 18.2.

3. August 2nd. The river being much higher, the same quantity of water gave insoluble matter 28.7, soluble 3. 0;—total 31.7.

4. August. 13th. The river had reached its maximum, and gave from the same quantity of water, insoluble matter 73.5 grains; soluble 2.7;—total 76.2.

5. August 20th. The water had hitherto been taken from the side, but as it was evident that the quantity of matter held in suspension in the middle of the current was much greater than towards the bank, where the water was nearly still, I took two separate portions as before, and obtained, from the middle, 40 grs. of insoluble residuum; from the side 20 grains ditto: add for soluble matter, suppose two grains to each, the middle gives 42, the side 22 grs. The river to-day was at the same height as on the 13th.

6. Sept. 7th. Two portions taken this day, as before, gave for the middle 19, the side 15.

7. Sept. 21st. The middle gave 22, the side 20:

The different proportion in this case was occasioned by a strong east wind agitating the water near the shore.

8. Oct. 4th. The middle gave 9.6, the side 5.1.

The numbers therefore stand thus :

|                  | Middle.    | Side.      |
|------------------|------------|------------|
| 20th August,.... | 42 .....   | 22         |
| 7th Sept.....    | 19 .....   | 15         |
| 21st, .....      | 22 .....   | 20         |
| 4th Oct. ....    | 9.6 .....  | 5.1        |
| Average          | <hr/> 23.1 | <hr/> 15.5 |

These numbers are to each other nearly as 3 to 2, so that we may correct the previous observations as follows :

|                |       |
|----------------|-------|
| 21st July..... | 27.3  |
| 2nd August.... | 47.5  |
| 13th———.....   | 114.3 |

The first rain fell on the afternoon of the 14th June, and we have unfortunately no observation for the first month of their duration, but I think 27.3, the quantity on the 21st July, would be rather a low than a high average for it. For the second month, viz. from the 15th July to the 15th August, we have three observations, which give an average of 63 grs. For the third month, we have two, with an average of 30.5 grs. For the fourth month we have two, giving an average of 15.8. So that the average for the whole period, from the 15th June to the 15th October, would be 34 grs. On the 15th March, 1832, a quantity of water taken in the middle of the stream gave 6 grains per quart: a mean between this and 9.6 (the weight obtained on the 4th October), or 7.8 grs., may be taken as the average from the 15th October to the 15th March, or for five months.

1.084 per quart was the weight obtained on the 27th May, from water taken at the side. If we correct this as before, it gives 1.63, and the mean between this and 6, or 3.8 will be the average for the remaining three months, from the 15th March to the 15th June.

I will here add such data as I possess respecting the breadth, depth, and velocity of the stream.

I found the breadth on the 15th March 1832, to be 660 yards. The distance up the bank to the maximum height of the rains was 158 yards more on the southern shore, and 38 yards on the northern; which reduced to a level, would give a total breadth of 2563 feet, for the maximum breadth of the rains; 1980 feet, being the least breadth in the dry weather.

On the same day, the total perpendicular fall from the maximum height of the rains was 28 feet. The whole breadth of 1980 feet, sounded at intervals of 300 feet, gave an average of 17 feet 8 inches, which added to 28, gives 45 feet 8 inches for the maximum depth in the

rains. The river had reached this maximum on the 13th August, and continued at the same until the 20th. After that it subsided as follows :

|                                      | ft. | in. |
|--------------------------------------|-----|-----|
| On the 26th August the fall was..... | 7   | 6   |
| 7th Sept.....                        | 5   | 2   |
| 21st Sept. ....                      | 5   | 6   |
| 27th Sept.....                       | 13  | 0   |
| 4th Oct.....                         | 15  | 4   |
| 25th Oct.....                        | 22  | 10  |

So that we may call the average depth for the third month of the rains 4 feet 3 inches below maximum, or in round numbers 41 feet. For the fourth month, viz. from the 15th Sept. to 15th Oct. the average depth would be 11 feet 3 inches below maximum, or 34 feet. For the first two months of the rains, the rise of the river was not measured, but from the quantity of rain that fell and the apparent increase, I cannot believe that the average depth would be less than the average for the fourth month, viz. 34 feet: If then we assume this number for the first two months, we have an average depth of 36 feet for the four months of the rains. A mean between 22 feet 10 inches (the fall measured on the 25th Oct.), and 28 feet (the fall measured on the 15th March), gives 24 feet 11 inches for the fall below the maximum in the intervening period, or in round numbers 20 feet for the actual depth during that period. For the three months of dry weather ensuing, 17 feet 8 inches may be taken as the depth.—We have seen that the least breadth in the dry weather was 1980 feet, and the greatest in the rains 2563 feet; leaving a difference of 583 feet. So that while the depth diminished 28 feet, the breadth diminished 583 feet, or 21 feet of breadth nearly for one of level. This proportion gives us 2383 feet for the average breadth during the four rainy months. Owing to the diminished velocity near the bank, and the diminished quantity of matter held in suspension there, this excess must be again reduced. Probably 2080 feet may be reckoned as the fair average breadth for the rainy months, 1780 for the winter, and 1730 for the hot months. The velocity, by the mean of two measurements on the 2nd and 14th April, 1832, at the surface, was 4425 feet per hour. I have no similar measurement for the maximum velocity in the rains, but while the river was at its greatest height I came a computed distance of 10 miles in an hour and a half, and from other observations of the same kind, both by myself and others, I am induced to estimate the maximum velocity at  $6\frac{1}{2}$  miles, or 34320 feet per hour. Assuming that the

velocity varies as the depth, we have 23,800 feet for the average velocity during the rains, 7435 feet for the winter, and 4425 feet for the hot months. I make no allowance for the decreased velocity of the stream near the bottom, because it is in all probability compensated by the increased weight of matter held in suspension there ; for the decreased velocity at the sides I have allowed by reducing the breadth. Our whole data therefore stands thus :

| Season.                    | Depth.<br>ft. in. | Average<br>breadth as<br>reduced. | Velocity.<br>ft. per hour. | Cubic feet<br>discharged<br>per second. |
|----------------------------|-------------------|-----------------------------------|----------------------------|---|
| Rains, 4 months, . . . .   | 36                | 2080                              | 23800                      | 494,208                                 |
| Winter, 5 months, . . . .  | 20                | 1780                              | 7435                       | 71,200                                  |
| Hot weather, 3 months, . . | 176               | 1730                              | 4445                       | 36,330                                  |

34 grains per wine quart was found to be the average for the rains. Now as a wine quart of water weighs 14544 grains, we have about  $\frac{1}{438}$ th part of solid matter by weight. But as the specific gravity of this cannot be stated at less than 2, we have  $\frac{1}{876}$ th part in bulk for the solid matter discharged, or 577 cubic feet per second. This gives a total of 6,082,041,600 cubic feet for the discharge in the 122 days of the rains :—7.8 grains per wine quart was the weight determined for the five winter months or  $\frac{1}{1558}$ th part in weight, and  $\frac{1}{3116}$ th part in bulk, which gives 19 cubic feet per second, or a total of 247,881,600 cubic feet for the whole 151 days of that period :—3.8 grains per wine quart was the weight allowed for the three hot months, which gives a  $\frac{1}{2632}$ th part by weight, and a  $\frac{1}{5264}$ th part by bulk, or about 4.8 cubic feet per second for the discharge of solid matter, and a total of 38,154,240 cubic feet for the discharge during the 92 days. The total annual discharge then would be 6,368,077,440 cubic feet.

In comparing these observations with some previous ones, I was glad to find that my average for the rains of  $\frac{1}{876}$ th part in bulk is nearly the same as that obtained by Captain Forbes, viz. 2 cubic inches in 1728, or 1 cubic foot.

I have stated the discharge for the hot months at 36,330 c. f. It is stated in the GLEANINGS at 20,000 at Benares. On looking over the data from which the estimates are drawn, I see that the product of the breadth and depth there given is greater than my own, the two products being to each other nearly as 5 to 8, but that the velocity I have found is to what is there given, nearly as 15 to 5. My measurements were made with care, and as I have been unable to detect any mistake in them, I have given the result of them in the hope that some one may be induced either to verify or contradict them. Again, there is a great difference between the discharge there estimated for the rains and my own results.

The former amounts to 1,372,500, or nearly three times mine, which is only 494,208. Had I made the estimate for three months of rain instead of four, my average of course would have been larger. There is too another reason why my estimate may be considered as lower than the truth. There is in the rains a small back stream, which forms an island of the opposite shore here. I examined this in the rains, but found the velocity of it so trifling, that I was induced to pass it over. Neither of these causes could raise mine to within one half of the Benares estimate.

III. *Note on the Magic Mirrors of Japan.* By James Prinsep,  
*Sec. Ph. Cl. As. Soc.*

[Read before the Physical Class, 13th June.]

The Japanese have long been celebrated for the manufactory of metallic mirrors, in which they carry on a considerable trade with China. They are ornamented with different devices on the back, and are well polished on the reflecting surface; but what constitutes their chief interest among Europeans is an adventitious property possessed by them, which must have originally been discovered by chance, although it is not certain at what period it became known, or whether the manufacturers, once apprized of the secret, have purposely cultivated its principle in the fabrication of their mirrors to give them an additional value in the market: the fact is known in China and among the English, but I believe no explanation has hitherto been suggested.

One of these mirrors was lately brought to Calcutta, and most of those whom I have the honor to address have had an opportunity of witnessing its effects; I have therefore the less cause to regret that its transmission to England has prevented my exhibiting it this evening. It has been sent home to a gentleman with whom its mysterious qualities will soon cease to be an enigma, if indeed they excite a moment's curiosity in his mind; but we have been surely a little hasty in allowing it to go from among ourselves, before we have attempted an explanation of the phenomenon it exhibited, as though we feared to hazard the investigation of so very simple a problem in optics, or have failed to discover its solution. To avert a suspicion of so derogatory a nature either to our zeal or to our optical acumen, I beg leave to offer the following explanation of the phenomenon to the consideration of the Society:

The Japanese mirror is a slightly convex disc of bell-metal, about six inches in diameter, and a quarter of an inch in thickness on the edge, ground and polished on the convex face, and covered with a

thin coating of silver to give it a white colour. The back of the mirror is deeply carved or indented with ornamental work in circles and festoons, and it bears an inscription in the Japanese character in high relief upon what may be termed the tympanum of the disc : in the centre there is a projecting knob perforated laterally to receive a string for suspending the mirror : the metal is highly sonorous when struck as a bell, and is so soft as easily to be indented or scratched on contact with any hard substance. I found its composition to be

Copper . . . 80

Tin . . . . . 20

100

with no traces of silver or arsenic, and a very slight indication of zinc. When a strong ray of light, as from the sun, is reflected from the polished surface of the mirror upon a screen, instead of a clear bright disc, as would naturally be expected, the spectrum is found to exhibit a tolerably clear delineation of the ornamental pattern on the back of the mirror: the outer circles; the festooned ring; the magical inscription, are all seen depicted with fidelity; and it certainly does stagger an observer for the first time to witness an image shadowed forth, without any visible origin; for the back of the mirror may be covered or concealed in any way without diminishing the effect.

No irregularity of surface was perceptible on the face of the mirror. It had been scratched in one or two places, and I put it into the hands of a silversmith to be repolished: in effecting this he rubbed off the plating in several places, and exposed the surface of the bell-metal: this, although in some respects a blemish, was one step in a *negative* investigation of the cause of the phenomenon, for the reflected image continued just as marked as before, merely being of a red colour where the silvering was removed; thus showing that the cause was unconnected with the nature of the reflecting surface.

As it was seen that the thick parts, the rim, the festoon, and the letters, were those which appeared most illuminated in the spectrum, an obvious explanation occurred, that the light was more perfectly reflected from thick surfaces than from thin ones, however such an assertion might militate against the known laws of metallic reflection, which all experiments have proved to be purely superficial or confined to an infinitely small depth below the surface: this hypothesis was easily put to the test of experiment, by casting some specula of very unequal thickness, and then grinding and polishing the upper surface: but when the mirrors were thus made, the image reflected from them was found to



be altogether smooth and natural, and the first supposition of course was no longer tenable. It then occurred, that the various parts of the Japan mirror might be of different *density*, supposing the pattern to be made by stamping, and that either the rays of light might be more forcibly repelled by the denser metal than by the lighter, or that parts of the surface would acquire different degrees of polish, sufficient to cause the illusion, although imperceptible to the eye. But in such case the thin parts, from being the hardest, should give the stronger reflection. This supposition was also overthrown by experiment. A disc of silver having been annealed at a red heat, so as to be quite soft, was stamped on the back with a circular ring, deeply indented, so as to harden the silver in that part only. The opposite surface was then ground and polished, when it was found to give a clear and uniformly reflected spectrum.

The third and, I believe, the true explanation was suggested by the well known phenomenon of the reflection from a brass button, which every school boy has remarked when sporting his Sunday "blue coat with metal buttons" in the sunshine of his tutor's parlour window. The button throws a radiated irregular image on the wall, exhibiting two bright concentric circles, one on the edge, and another about one-third within it : and there is generally a bright spot in the centre ; all of this seems but the picture of the stamp on the back of the button : the radii resemble, and indeed coincide with the letters of "superfine" or "trebly gilt" inscribed within a double circle, and the central spot represents the shank: there can be little doubt, that the principle is in this case precisely that of the Japan mirror, and on cursory view, the surface looks equally smooth and unsuspecting. On minute examination, however, of several buttons, I found them to be by no means plane ; their general surface is slightly convex ; there is a hollow in the centre, and a projection in the position of the inscription behind, caused no doubt by the blow necessary in stamping it—the polish is probably given by a rotatory motion, and consequently does not remove these very small irregularities. To follow up the experimental investigation, I selected one of the buttons, which gave a good image ; ground it on a flat hone, and polished it : all of the magical figures vanished in a moment, and a plain bright disc appeared in their stead ! Here then may be a key to the mystery of the mirror : the deception is entirely produced by irregularities on the surface, which are rendered the less perceptible to the eye, because the surface is convex instead of being plane.

But it may be objected, that the two circles which appear bright in the reflected spectrum of the button, represent the *indented* or thin parts

of the metal, whereas the *thick* parts of the Japan mirror are those which appear illuminated. A short analysis of the facts in either case will readily explain to what these discrepancies are attributable, but it will be necessary to have recourse to a diagram.

Let A B Pl. VI. *fig.* 1, be a plane mirror, upon which the rays of light R impinge : they will be reflected uniformly in R' forming a clear image.

Now let A B C D E F G be another reflecting surface, having two convexities, B C, E F; and one concavity in the centre, D; (the conditions nearly of the brass button.) In this case the light R R reflected from the outer concave flexures of the protruding portions of the surfaces B C, E F, will converge in the foci *b, c,* and *e, f,* respectively, at distances corresponding to the radius of their curvature : the effect will of course be visible within wide limits of the actual focus. In most of the buttons however the central depression is so great, that it collects the rays in a focus *d,* a few inches only in front of the surface; and when the spectrum is thrown farther off, the rays, crossing, form two less distinct luminous foci at *d' d''*.

It follows from analogy that the thin parts, or tympanum, of the Japanese mirror, are slightly convex with reference to the rest of the reflecting surface, which may have been caused either by the ornamental work having been stamped, or partially carved with the hammer and chisel on its back; or, which is more probable, that part of the metal was by this stamping rendered in a degree harder than the rest, so that in polishing it was not worn away to the same extent. That the curvature is extremely small, is proved by the circumstance of the image being nearly equally well defined at the distance of two or twenty feet, or within all the limits at which I had an opportunity of trying it.

Advantage might be taken of this exceedingly simple principle, to produce a multitude of curious effects; and I have little doubt that, in the skilful hands of an English artist, it will be converted into a philosophical toy, as amusing as the optical paradox, or even the far-famed kaleidoscope itself.

#### IV.—*Description of the Native Manufacture of Steel in Southern India.*

[Extracted from the manuscript journals of the late Dr. Voysey.]

*Kona samundram*, (corner of the sea,) situated about 12 miles south of the Godaveri, and 25 from Nirmul, is celebrated for its manufacture of steel, the chief part of which goes to Persia; the following are the chief details of this manufacture, collected by repeated visits to the place, and personal inspection of the process.

The furnace is a temporary circular structure of clay, from four to five feet in height, and five feet in diameter. It is sunk two feet below the surface of the ground. The fuel is charcoal, and the fire is kept up by a blast from four bullock skins, placed at right angles to each other: the muzzles resting on the upper edge of the furnace, so as to force the blast downwards. The granitic clay of the furnace is highly infusible; it is found in the neighbourhood, and is formed of the decomposition of granite rock with small pieces of quartz and felspar, and is so valued for its refractory qualities, that it is exported for the manufacture of crucibles, &c. After some days, however, if a considerable heat has been maintained, the furnace becomes semi-vitrified, and requires renewal; the cost of a furnace is from two to three rupees.

The bellows are plied incessantly day and night: during the operation, the men are relieved every four hours, each being engaged to work 12 out of the 24. They are partly protected by a screen of mud placed between them and the furnace, but the heat and exertion render their task sufficiently laborious.

The iron is converted into steel in pine-shaped crucibles, made of the same clay as the furnace, and of various sizes, according to the purpose for which the steel is to be applied, whether for the fabrication of swords, or knives, or other articles.

In making the crucibles, the granitic clay above described is ground to a fine powder along with the fragments of old furnaces and crucibles, and the whole kneaded together with the chaff of rice and oil. The vessels are defended by a luting of the same, they are covered with a similar top, but a perforation is made in the latter. No charcoal is put into the crucible, but small pieces of *kunch*, or the glass formed in the process, are put at the bottom of them along with the ore, and serve of course as a flux. The crucibles are arranged and steadied in the furnace occasionally by the superintendent, with a long and stout rod of iron.

The materials used in the preparation of the steel are two different kinds of iron; one from *Mirtpalli*—the other from *Kondapur*, in the proportion of three parts of the former to two of the latter. The *Mirtpalli* iron is derived originally from the iron sand already noticed, and is sent in the state of large amorphous masses of a reddish grey color, and of an extremely porous texture. The internal fracture is often iridescent. The *Kondapur* iron is procured from an ore found amongst the iron clay, at a place about 20 miles distant. It is said to be of a dirty brown colour, and very frangible. The iron

however, is moderately compact and of a brilliant white fracture. Occasionally it contains some ingredient which spoils the steel, rendering it excessively brittle: the natives assert that the adulteration is copper, but it is more probably arsenic. The mixture being put into the crucible, the fire is excited and kept up for 24 hours. It is then allowed to subside, and the crucible is taken out and placed on the ground to cool. When quite cold it is opened, and a cake of steel of great hardness is found, weighing on an average about a pound and a half. The cake is covered with clay, and annealed in the furnace for 12 or 16 hours. It is then taken out and cooled, and again annealed, and thus may be repeated a third or fourth time until the metal is rendered sufficiently soft to be worked. The steel is known by the name of *Wootz* in Telinga, and a *Kurs*, a cake of about 110 rupees weight, is sold on the spot for 8 annas. The daily produce of a furnace is about 50 seers, or in value 37 rupees. The cost of this steel is much enhanced by the exaction of the *jaghiridar*, who not unfrequently appropriates the advance to himself, and leaves the purchaser still to incur the whole expence.

The export, however, of the metal to Persia must be profitable, as it is sufficient to bring dealers from that country and to defray the cost and risk of travelling. We found at the village, in 1820, Ilájí Hosyn, from Ispahán, engaged in the speculation; and it must have answered his purpose, as he was here again in 1823, having returned in the interval to Persia and disposed of the venture. He informed us that the place and the process are both familiar to the Persians, and that they have attempted to imitate the latter without success. Besides residing at the village, whilst making his purchases, he bore a personal part in the operation, weighing the proportions of the iron, and testing the toughness of the steel himself.

The following experiments may convey some notion of the degree of heat to which these furnaces can be raised, and which may be reckoned at 130° of Wedgwood. 25 rupees weight of steel, which had not been submitted to the last operation, with  $\frac{1}{164}$ th of a silver rupee, was fused in three hours into a button of hard steel. A piece of shelly stratum from *Jhirpa* fused into a sort of porcelain. A piece of hornblende schist was fused into a glass, with many globules of iron, and manganese floating on the surface. The granite from the bed of the *Godaveri* yielded a green glass. *Belkonda* granite was partly run into a green glass with pieces of quartz little altered, floating on the mass. *Sitabaldí* basalt was melted into a yellowish green, and *Jhirpa* wacken into a very perfect opaque black glass.

## V.—Proceedings of Societies.

## 1.—ASIATIC SOCIETY—Physical Class.

Wednesday, 13th June, 1831.

James Calder, Esq. in the chair.

The chairman communicated the offer of Dr. H. H. Spry of Sagár, to correspond with the Physical Class, on Geological subjects, which was accepted with thanks.

## Correspondence.

1. The following letter was read from Mr. J. D. C. Sowerby, acknowledging the receipt of the Himalayan Fossil Shells sent to him for examination, at the suggestion of the Rev. R. Everest, in 1831.

To James Prinsep, Esq. Sec. Ph. Cl. As. Soc.

SIR,

I feel highly honoured by the resolution of the Physical Class of the Asiatic Society, forwarded to me in your letter, dated the 26th of January, and request you to present my thanks to the Society for the series of specimens which I have lately received.

I had before seen some specimens from the same mountains, in the possession of Mr. Stokes and Dr. Buckland, among which were several ammonites that are as yet unnamed. The Rev. Mr. Everest's deductions are correct, as far as they relate to the formations the fossils belong to, as you will see by the accompanying list of names, to each of which I have added the formation in which that species occurs, in England.

In the genus *Terebratula*, there are many species that cannot be depended upon as indicating particular formations, because very similar ones are found in several beds, and the species are difficult to determine, especially if not quite perfect. You speak of a *Pecten*, which Mr. Everest thinks does not differ from the common Scallop, it is very probably *P. æquivalvis*, which is characteristic of the inferior Oolite; both of its valves bear a strong resemblance to the convex valve of *Pecten maximus*. The *Helix* you speak of may possibly be *Ampullaria nobilis*, which accompanies the *Cirrus* in the lower beds of the mountain limestone of England and Ireland.

Allow me to repeat, that I am sensible of the honour conferred upon me by the Asiatic Society, and shall always take a pleasure in replying to similar communications, or in being in any way serviceable to science.

I remain,

5, Camden Terrace,  
West Camden Town,  
London, Oct. 14, 1831. }

Dear Sir,  
Your faithful servant,  
J. D. C. SOWERBY.

## List of Fossil Shells from the Himalaya.

Fig. 1. (See GLEANINGS III. Plate XVII.) *Avicula* (rather than *Pecten*), species new.

2. *Spirifer striatus*, [Min. Con. tab. cclxx.] Mountain Limestone.

? Cast of the interior of *Spirifer striatus*, Mountain Limestone.

3. *Producta scabricula*, [Min. Con. t. lxxix. fig. 1.]

————, new species.

These two and the *Spirifer striatus* are in a stone strongly resembling some of the Transition Slate of England, which contains similar shells.

4. *Astarte planata*, var. [Min. Con. tab. cclvii.] Inferior Oolite.

• A variety of this shell is found at Bayeux in Normandy, and is called *Crassina modiolaris*. Also an unnamed large bivalve.

5. *Nucula*, an unnamed species; similar fossils occur in the Mountain Lime and Lias.

7. Strongly resembles a portion of some large *Inoceramus*, but it is not perfect enough to determine.

12, 13. *Ammonites annulatus Anguinus*, of Schlotheim, Zeiten, Versteinerungen Wiirtembergs, t. ix. f. 2. Min. Con. tab. ccxxii. fig. 5, is the same shell. Lias formation. The large specimen is filled with sulphate of barytes, not carbonate of lime.

No. 24. *Belemnites sulcatus*, Sillot, Miller, Trans. Geol. Soc. 2nd series, vol. II. pt. 1, pl. 8, fig. 3, 4, and 5. *Bel. apiciconus*, Blainville's Memoire. Lias, inferior Oolite.

23. *Alveolus* of a Belemnite, perhaps of *B. sulcatus*. *Orthocera conica* of Min. Con. tab. lx. although called an *orthocera*, is only an *alveolus* similar to this.

2. The following letter from Dr. Falconer, Superintendent of the Hong Company's Botanic Garden at Seharanpúr, was read.

#### *Dehra Dún Fossil Remains.*

To the Editor of the Journal of the Asiatic Society.

SIR,

In No. 3 of the Journal of the Asiatic Society, p. 97, Mr. Royle has announced the discovery by me of the fossil bones in the range of hills which skirts the Valley of Dehra on the south-west. I regret that Mr. Royle did not confine himself to a simple announcement of the fact, without giving an extract from the letter in which it is mentioned. The communication was made immediately after I had met with the fossils, and was an unguarded expression to an intimate friend, of what I imagined them to be, and not an opinion intended for a public Journal in the *ipsissima verba* of the letter. Beyond, therefore, the fact of fossil bones occurring in these hills, I do not wish to stand responsible for any opinion regarding their specific determination, in the present imperfect state of the inquiry. As yet they have been found in a small quantity only, and consist of a few fragmented portions of bones. The Lignite occurs in great abundance. The "fragments of the shells" (not the *skull* as stated in the Journal) of *Tortoises* resemble those found by Mr. Crawford and Dr. Wallich on the banks of the Irawadi, and others contained in the museum of the Asiatic Society. The "fragment of a bivalve shell" is very imperfect, and therefore very questionable.

I conceive it necessary to state that Lieut. Cantley, Superintendent of the Doab Canal, is the original discoverer of fossils in these hills. The most perfect portion I have yet seen of these fossil bones, has been in his possession several years, without however, his being aware of its nature.

H. FALCONER.

*Seharanpúr, May 28.*

*Museum.*

3. Specimens of the coal strata lately discovered at Sanárím, and near the Sanatarium in the Kasya Hills, were presented by the President in the name of Mr. W. Cracroft, with explanatory extracts from his letters.

The quality of the best specimens or middle stratum of this coal differs considerably from that of the Burdwan coal : it contains very little earthy matter ; it burns with much flame, but does not form coke ; spec. grav. 1.330, colour brown black ; composition,

|  |    |
|--|----|
| Volatile matter (of which aqueous, 7.5)..... | 45 |
| Carbon, .....                                | 53 |
| Earthy residue, ... ..                       | 3  |

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100

4. Specimens of iron ore (red clay iron), from Sambhálpúr, presented by Capt. Jenkins, on the part of Mr. Babington : also a box of Himalayan minerals, found at the Adj't. Gen.'s office, by Capt. Jenkins.

5. The following specimens of the iron ores of the Salem Hills, Southern India, and of the iron and steel in the various stages of its manufacture, according to the native processes, by Mr. Heath, M. C. S.

I. Magnetic Iron ore from Salem, in its natural state, mixed with quartz.

II. The same ore cleaned by stamping and separating the quartz.

III. The same ore crystallized in octohedrons. This state of the mineral is rather rare.

IV. Some specimens of cast steel made from this ore by the native process, together with the crucibles in which the steel is melted. Some of these are left open to shew the manner of charging them ; others are stopped up ready to be put into the furnace.

V. Some specimens of chromate of iron from a mine lately discovered, and of Bichromate of Potash made from it.

*Papers communicated.*

6. Observations on the quantity of earthy matter brought down in the river Ganges, by the Rev. R. Everest.

[Printed in the present number, page 238.]

7. Report on the progress of the boring experiment, by Dr. Strong.

Since the last report considerable delays have taken place by the sickness of the superintendent. The boring No. 1, near the church in the fort was found so much injured by the searching after and extraction of the 100 feet of broken rods, that further operation in that quarter was abandoned after tubing the hole to the depth of 100 feet, and building over it a pump. There the depth obtained was 175 feet, and the water, which is sweet tasted, but muddy and ferruginous from the tubes, continues to stand at a level of 7 feet from the surface of the ground.

A second operation was commenced not long ago on the south end of the glass plot behind the Government house in the fort. Here the conductors of the experiment have adopted the use of a borer double the former size, and have in consequence easily forced down a strong sheet iron tube seven inches in diameter to the depth of 70 feet. Thence with a 6-inch auger

the perforation has been carried down to the depth of 130 feet, without much difficulty, and a 6-inch tube has been already sunk into it to a depth of 117 feet. Thus far the progress has been very satisfactory, and with the assurance of an iron shaft through the two strata of sand connected with the river at 30 and 70 feet beneath the surface, the experiment promises fair to make us acquainted with the nature and quality of the water at greater depths, whether it may be entitled to the name of an artesian spring or not.

8. Note on the Japanese Mirror, by the Secretary.

[Printed in the present number, page 242.]

9. Mr. B. H. Hodgson's paper on the *Buceros Homrâi* of Nipal, and Dr. Bramley's remarks on the skeleton of the same bird, were then read.

The *B. Homrâi* is the largest species yet discovered of the singular genus, measuring 4½ feet from the bill to the tail, and 6 feet in expanse of wings.

It tenants the lower range of hills from Haridwâr to Assam, and is not truly migratory, though it retires to the neighbouring mountains during the breeding season. It has been a prevalent opinion that the *Buceros* is carnivorous, but Mr. H. has on shooting two species out of four, found their stomachs filled exclusively with fruit, and the other two in domestic confinement shewed always a great aversion to frogs and lizards, and refused to touch rats, mice, and birds; they were fed entirely on fruits and boiled rice: both would however eat fresh meat, when vegetable diet was out of their reach.

The *Homrâi* reaches its full size in four and five years; it is gregarious and sedate; seldom alights on the ground; its ordinary voice resembles the croaking of a bull-frog, but when excited, it vociferates vehemently like the braying of an ass. The bill is nearly a foot long, very large, cleft to the eye, and strongly arched: the cutting edges brittle and broken in the centre: the casque, about 8 inches long, broad, flat at top; front in young birds pointed and continuous, becoming crescented and separated from bill in maturity and colour of casque; upper mandible, deep waxen yellow, passing into orange red; lower mandible, white; base of both, anterior of casque, inner surface of bill, &c. black; iris, crimson; legs, green grey; skin round the eye, black; body and wings, chin and junction of the head and neck, black; neck yellowish white; tail pure white with a broad black bar; all but the two first quill feathers of the wings broadly whitened at either extremity. Tips of the long coverts also white. The female and young are marked like the male.

The anatomy of the skeleton is minutely described by Dr. Bramley, particularly the connection of the horny and bony substance of the mandibles.

The tongue is fixed to the lower mandible, small, and triangular, without papillæ.

The cervical vertebræ are only 12 in number; the dorsal, seven, and capable of motion, whence he infers a limited power on the wing.

The *os hyoides* consists of five bony portions; the superior *larynx* is formed anteriorly and laterally of bone, and the *annuli* of the *trachea* are all more or less ossified.



The thanks of the Society were voted for the several communications of the evening.

*Kasya Coal.*

Mr. W. Cracroft's information respecting two new localities of the Kasya Coal is contained in his letters addressed to the Honorable Sir Edward Ryan, dated May, 1832, from which the following are extracts.

"I hasten to give you a piece of information, which will interest you. I have just returned from Sanárim, where Mr. Furnell discovered a stratum of Coal cropping out on the side of a hill. I went down to examine it instantly, and found it with its cieling of new sandstone of an ochry color; below that a stratum of six inches light bituminous coal, a little tinged with ochre: next a stratum of 18 inches fine bituminous coal; under this, slate very bituminous, about six inches, and a floor of bituminous sandstone, to what depth I know not; it extended right and left as far as the *jungal* would permit us to see, and had little or no dip in any direction. The accompanying sketch (Plate VI. fig. 4) will give you a better idea of it than my verbal description. I send you specimens of all but the sandstone, which was lost on the road.

23rd.—"In consequence of our desire for coal becoming known at Chirra Pánjí, two specimens were brought me yesterday, one of which resembled the Sanárim bituminous coal, the other the slate. I therefore inquired for some one to shew me whence they came. To-day we mounted our horses, Col. Watson, Mr. Rhodes, Mr. Furnell, and myself, accompanied by nine coolies with pickaxes, &c and were conducted to the foot of the limestone hill, west of the Sanatorium. After passing the stratum of limestone, we came to sandstone, and were shown a stratum of coal, (specimen No. 1,) two feet eight inches thick, with a roof (No. 2); below the coal, was No. 3, but we could see no further. This was satisfactory enough, so we left our coolies to load themselves with coal, and Mr. F. and myself mounted still higher to see if there might not be another stratum. We passed various sorts of sandstone, climbing nearly perpendicularly about sixty feet, where we found lumps of fine coal bedded in clay; and proceeding at an angle of about 35 degrees, perceived evidently another stratum cropping out, but buried in the clay. Leaving this we reached the top of the hill, whence we enjoyed a beautiful view of the Sanatorium. Our guide brought us back by an easier road; but imagine our delight, at finding in our descent the continuation of the lower stratum of coal perfectly bared, perpendicular from top to bottom; here I of course took new measurements and specimens, of which

A is the roof.

B bituminous coal, 2 feet.

C slaty coal of various consistence, 2 feet 4 in.

D coal tinged with other joints nearly perpendicular, 2 feet 1½ inch.

Depth of the coal stratum 6 feet 5½ in.

E is a specimen of the floor.

F found at top.

The rock being nearly perpendicular enabled me to come to pretty accurate measurement, and I found the shell limestone between 40 and 50 feet below the coal. I measured more than 39 feet of the stratum of limestone, and estimated about twice as much more below that, but the quality and texture are not quite the same, (but of this hereafter.) I consider the highest point we reached, to be

about 400 feet above the place where we left our horses. The accompanying sketch, Plate VI. fig. 5. exhibits a section of the hill.

The stratum sinks about half an inch in a foot toward the south, but the roof, where we found it projecting, basets nearly horizontally, and the face of the rock bears about N. E. This stratum of coal will be invaluable to the station. I shall forward a bag, by the first opportunity, for your inspection; it can be supplied at Chattak at 6 annas per maund, with good profit to the supplier, and the quantity is, I imagine, inexhaustible. I have no doubt it will be followed up, and found nearer the head of the pass, i. e. at Músmye. A box of specimens will reach you by Dák bangy: they will I hope enable you to judge fully of the value of the discovery. I am certain that these mountains, the aptitude of which to support colonists will inevitably lead to their colonization, contain resources far beyond our present estimation of them. Mr. Furnell discovered a large cavern, from whence he brought away a specimen of sulphate of lime in silky crystals. We also found an extraordinary natural well: a stone thrown into which fell into water at the end of about three seconds from dropping it."

#### *Salem Iron Works.*

The following memoranda on the subject of the Salem works, calculated soon to become important from their magnitude and from the well known zeal of their founder, are gleaned from private documents, with the perusal of which we were favored by the Agents of Mr. Heath, in Calcutta, who also presented his specimens to the Society:

The mine from which Mr. Heath draws his supply of ore is situated in the Salem district, close to a place noted on Arrowsmith's large map of India as *Shenda-mangalam*, in lat.  $11^{\circ} 21' 30''$  and long.  $78^{\circ} 17' 30''$ .

There is abundance of fuel in the neighbourhood: it is within 20 miles of the river *Kavari*, which is navigable to the coast in the country boats.

The iron ore, a magnetic oxide of great purity, is stated by Mr. Heath to form hills of considerable size; it is in small grains, interstratified with quartz, and occasionally in regular octohedrons. This crystallized oxide is one of the richest ores of iron known; it consists according to Berzelius of 72 parts of peroxide and 28 of protoxide of iron. Some of the crystals sent are covered with a white micaceous coat, which is esteemed a sign of superiority by the natives: the specific gravity of the octohedral crystals was found to be on an average 5.136 at  $60^{\circ}$ , which is rather more than is allowed in mineralogical works. Mohs, the most accurate physiognaphist, calls it 5.096—Phillips, only 4.4.

On reference to the manuscript journals of the late Doctor Voysey, (from which an extract is given in the foregoing pages,) it appears that in the Godaveri iron works, ores of iron sand, and iron clay are used, which are more easy to reduce than the pure magnetic oxide, although far less rich in metal.

Mr. Heath has hitherto confined his attention to the manufacturing of bar iron, for which purpose he has set up blast and puddling furnaces, with blowing engines, fineries, and machinery for working the iron into bars commissioned from England, capable of giving a monthly return of from thirty to forty tons. We know not precisely whether Mr. Heath has as yet matured his substitution of the methods of our own country in the place of those which have from time immemorial prevailed among the natives of the place: the specimens at present under examination, are evidently intended to illustrate the native operations. We should

imagine the greatest drawbacks to the success of the new method must be in the want of coal fuel, and of ready access to a market of sufficient consumption.

Mr. Heath's specimens of the native process of making steel are interesting, on account of the ignorance which still prevails in Europe on this subject.

According to the author of the *Treatise on Manufacturing Iron and Steel* in Lardner's 'Cabinet Encyclopedia,' our latest authority on such subjects, the right nature of Indian steel seems to be still as much an enigma as ever: nothing having been added to our knowledge since Dr. Pearson's paper on the Wootz steel, in the *Philosophical Transactions*, Vol. XVII. There it is asserted that the steel is made directly from the ore by fusion, and that it has never been in the state of wrought iron. "The mass has evidently been fused," says Dr. Pearson, "but the grain of the fracture is such as I have never seen in cement-steel before it has been hammered or melted;" and he suggests, that the variegated appearance of articles manufactured from it, is owing to portions of the oxide of iron having escaped metallization when melted up with the rest of the matter.

Dr. Voysey however expressly describes the compact texture and brilliant white colour of the iron used for conversion into steel; and in confirmation we have now from Mr. Heath, "the actual crucibles with broken fragments of iron bars, (about one lb. in weight each) charged ready for fusion, along with uncharred wood and green leaves;" the wood used for the purpose is that of the *cassa auriculata*, and the green leaves are those of the *asclepias gigantea*." The cementation takes 24 hours, and the fire is then urged so as to fuse the steel. On breaking the crucible it is found in a hemispherical button, radiated on the surface as from crystallization. It has gained somewhat in weight; it is very hard, and requires to be annealed three or four times, covered with clay, and exposed to a red heat for 12 or 16 hours. This would be an argument that too great an absorption of carbon had taken place, and that the metal was in fact cast iron. 100 grs. of Mr. Heath's wootz, however, when dissolved in sulphuric acid, left but  $\frac{1}{16}$  grain of carbonaceous matter, which is less than the usual proportion.

The brittleness of the wootz steel has been notorious ever since Damascus blades have been known in Europe and Asia. Tavernier describes the difficulty of working up the metal in his day as precisely what is experienced in the specimens before us. "The steel susceptible of being damasked comes from the kingdom of Golconda; it is met with in commerce in lumps about the size of a half-penny cake: they are cut in two, in order to see whether they are of good quality, and each makes half the blade of a sabre." He adds, that if the European methods of hardening this steel were followed, it would break like glass. Reaumur and others have always alluded to the same difficulty of forging it.

The cause of the brittleness may be in the over-carbonization, alluded to above; otherwise it must be sought in the wood used for the purpose; this point has not yet received elucidation, &c. nor from the unsatisfactory nature of all chemical analyses of iron is it likely to be soon explained.

Mr. Heath's *chromate of iron* ore seems to be of a very good quality, containing little or no foreign matter. It is of a dark greenish-grey or nearly black color, granular texture, in massive lumps, inclining to a octohedral form: not magnetic, infusible, insoluble in acids: specific gravity 4.545 at 90°.

Nitrate of potash requires more than a red heat to effect its decomposition: by caustic potash it is more readily acted on, and discharges copious fumes of a greenish, yellow colour, found to consist of sublimed chromate of potash soluble in

water. The fused mass in the crucible, also, on solution yields a copious yellow precipitate with acetate of lead; but the operation requires to be repeated several times before complete decomposition of the ore takes place.

The crystallized *bichromate of potash*, made by Mr. Heath, appears to be perfectly pure, and would be sure of a market in Europe. It is this substance which is used for dyeing. A short description of the process is given in Ure's translation of "*Berthollet's Arts of Dyeing*." All shades of orange and yellow may be produced by adding to the solution of the salt, acids or alkalies; the acids rendering the color deeper, and the alkalies, lighter. The mordant generally used is sugar of lead. The salts of mercury may also be employed, but they are more expensive." Mr. Heath recommends the bichromate as suitable for the dyeing of Choppals, Bandannoes, &c. Cotton twist however would be dyed much cheaper at the place where the dye was extracted from the chromate of iron, as in this way the process of crystallization would be rendered unnecessary. Mr. Heath has, in anticipation of a demand for this new product, established an extensive apparatus for its manufacture, and another for the manufacture of acetic acid, so as to enable him to supply the sugar of lead at the cheapest rate.

Chrome yellow, or chromate of lead, is much used as a pigment, but it has hitherto borne a very high price. America and Russia have furnished the greater part of the European supply: the Americans prepare it with saltpetre taken from this country, and chromate of iron from Baltimore and New Jersey, an ore by no means so pure as that discovered in Salem. It is natural to expect therefore that all the preparations of chrome will soon be advantageously exported from India.

The chrome yellow might find a market in China and the Burmese empire, as a substitute for the yellow sulphuret of arsenic, now extensively employed in the ornamental work of the lacquered-ware.

## 2.—MEDICAL AND PHYSICAL SOCIETY.

2nd June, 1832.

Messrs. D. McLeod, J. Stokes, S. Ludlow and O. Wray, proposed at the last Meeting, were elected Members of the Society; and Drs. Blest and Passaman, of Chili, were elected Corresponding Members.

Cloquet's Quarto Work on Anatomy, and Manec's Plate of the Cerebro-Spinal Nerves recently received, were placed on the table; also Specimens of *Chulchulera*, (lichen,) forwarded by Dr. Falconer.

The following communications were then laid before the Society:

1. A letter from Mr. Cope, stating, that in proceeding up the Ganges to Dinapore, he had met with a species of Argemone; the *A. Mexicana*, the seeds of which contain a large proportion of fixed oil; and he observes, that prior to his leaving England, a quantity of oil of the *A. Mexicana*, the produce of the West Indies, had been used in London as a mild purgative. Mr. Cope wishes to bring this subject before the notice of the Society, in hopes that the plant may afford an useful addition to the Materia Medica of India.

2. A letter from Superintending Surgeon G. Playfair, to the Medical Board, containing a brief notice of an Epidemic Influenza that had appeared at Merut, on the 7th April; and in the course of 10 days, affected above 200 men of H. M. 26th Foot. The disease was marked by violent catarrhal symptoms, and pains in the back and limbs. The Epidemic appeared at Bareilly early in April, but no instance of a fatal termination was known.

3. A letter from Mons. Desjardins, containing the procès-verbal of the Meetings of the Society of Natural History of the Mauritius, from the 20th December, 1831, to the 17th January, 1832.

4. Dr. Casanova's account of the Medical properties of the Mineral Waters of San Pedro, in the Havanna; being the result of an examination of those waters, and a topographical account of the district, undertaken by order of the Colonial Government. The springs alluded to are thermal sulphureous; and their medical properties were found to be diuretic, aperient, and tonic. The treatise embraces an account of the diseases in which these waters have been found useful, as well as instructions for their employment.

5. Dr. Woodburn's account of Cholera, in the district of Sherghatf, presented by the Medical Board.

6. Mr. A. K. Lindsay's case of complicated Visceral disease, in which urinary calculi were found on dissection, presented by the Medical Board.

7. Observations on Hepatic Abscess, by W. Geddes, Esq. Surgeon of the Madras European Regiment.

8. Mr. Hutchinson's letter proposing the publication of a Quarterly Medical Journal;—to consist of a selection from the best medical publications; with an appendix to contain any papers of minor importance, or ephemeral interest, that might have been laid before the Society in the interval; and a précis of the latest medical intelligence, as well as an account of the proceedings of the various scientific bodies at the Presidency. The work to be supplied to the members of the Society at prime cost, or even gratuitously; and a small profit realized by the sale of extra copies at a higher price.

The expediency of making some of the Society's publications convey early intelligence of important discoveries in medicine, and of the progress of medical science in general, without any expence to the members, has been already twice brought to the notice of the Society, and some steps taken with a view of altering the form, and very much increasing the size of the Monthly Circular; for the purpose of comprehending an account of the progress of medical science in other parts of the world, so arranged as to admit of being bound up in a volume at the end of each year. The Society's annual publications would thus comprise one volume, principally composed of the discoveries in every branch of the profession in other parts of the world:—besides the volume of Transactions, as heretofore published.

9. Mr. Raleigh's remarks on an instrument for depressing the Cataract, by which he hopes to secure all advantages belonging to the native mode of operating, when performed in the best and most successful manner; at the same time, that many of the dangerous consequences frequently attendant on their mode of operating, may be avoided. A specimen of the instrument devised by the author, was sent for the inspection of the Society; its shape somewhat resembles one blade of a midwifery forceps on a very minute scale. It is fixed in a handle like the common couching-needle: the blade is about an inch in length; the two-thirds next to the handle being round, the remaining third spreads, so as to form an oblong oval shallow spoon, the centre of which being cut out leaves an oval ring; and its extremity is bent slightly forward; the widest part of the oval measures about the tenth of an inch, but the thickness does not exceed that of a couching-needle. The mode of operating is as follows:—with a lancet-shaped knife, a vertical puncture is made the eighth of an inch in length through the

coats of the eye, three lines behind the junction of the cornea and sclerotic ; and the new instrument is introduced with its concavity forwards and edges vertical ; it is carried behind the lens, over the upper edge of which the concavity of the instrument is placed, and depression effected in such a way as to separate all the attachments of the capsule, and to lodge the lens and its capsule at once below and behind the pupil ; the handle of the instrument may then be rolled between the finger and thumb, so as to disengage its blade from the lens ; and the instrument is to be withdrawn. The author considers Mr. Breton's estimate of the failure of couching in the hands of the natives, (taken probably from their own operators' representations,) to be erroneous ; and that instead of 10 per cent. of failures, 40 or 50 per cent. might be a more correct average. He says, from having seen the native oculist mentioned by Mr. Breton, put out four eyes in succession on the same morning, in two of which cases the lens was pushed into the anterior chamber, and in one the iris torn in half ; and from having constantly patients brought to him whose eyes were destroyed in consequence of the native operation : he is inclined to consider couching as performed by the native oculists, barbarous and unscientific. He altogether discredits the account of the native operation having been performed seven times on one eye, with ultimate success. The author states, that in a fair proportion of cases in which the new instrument has been used, the operation has been successful ; but he cannot yet decide whether the subsequent inflammation, generally speaking, is greater than after the European mode of couching. In several cases, however, it has been severe ; and he thinks constitutes the principal, and, perhaps, the only solid objection to the operation performed in the manner he has now advised.

Mr. Mercer's paper relative to vaccination and varioloid diseases was then read and discussed by the Meeting.

### 3.—AGRICULTURAL AND HORTICULTURAL SOCIETY,

*The 14th June, 1832.*

Sir Edward Ryan, President, in the Chair.

The following Gentlemen were admitted Members of the Society, viz.

- 1.—Lieut. Colonel Thomas C. Watson, European Regiment.
- 2.—Mr. Richard Hunter, C. S., now of Cuttack.
- 3.—Captain W. Badenach, 57th N. I.
- 4.—Mr. George T. Lushington, C. S.

The following letters were read :

1. From the Secretary of the South Carolina Agricultural Society, to Mr. Piddington, Foreign Secretary, dated 31st October last, acknowledging receipt of this Society's circular letter of the 1st of the preceding March : offering to supply any indigenous plants and seeds that may be required ; and presenting some publications of the South Carolina Agricultural Society.

2.—Mr. Piddington was requested to acknowledge the receipt of these publications, and to procure a parcel of seeds for the South Carolina Society.

3.—From Captain Cowles, two letters, dated Diamond Harbour, 8th and 24th ultimo, presenting two samples of Sugar, of his manufacture, and furnishing some particulars of the proofs, &c.—The thanks of the Meeting were voted to Captain Cowles.

4.—From Mr. Kyd, dated 9th ult. presenting some China Potatoes for seed. The Secretary stated that he had forwarded the Potatoes to the Allipore Garden.

5.—From Mr. Willis, dated 9th ultimo, recommending that Government should be requested to require from Major Burney, the Resident at Ava, as large a quantity as possible of the long staple Pernambuco and other good descriptions of Cotton Seed, grown in that country, and that he be furnished with American Cotton and Tobacco Seeds for introduction there.

The Secretary informed the Meeting, that he had forwarded a copy of Mr. Willis' letter to Government, and had offered, with reference to the suggestion in the latter part of it, to supply any quantity of Seeds that might be required.

6.—From Messrs. T. A. Pitkin and T. C. Robson, dated 22nd ultimo, presenting specimens of American Flax and Tobacco, grown on their lands in the Soonderbunds, from seeds furnished by the Society, and requesting instructions as to the manner of curing the latter.

The Secretary was requested to furnish these gentlemen with copies of the methods followed by Mr. Deverine, the Society's Superintendent at Akra.

7.—From Mr. Pattle, with a Mangoe of uncommon size, grown in his own garden, and which Mr. Pattle considers the result of care and cultivation. It was found to weigh 1.5 Sa. wt. and to be 20.4 by 17.4 inches in circumference.

8.—Mr. Richard Hunter presented a specimen of Pernambuco Cotton, found by him in Cuttack, which appeared to be of good quality, and to thrive well, but he had not been able to obtain any information as to how it had been introduced there: the specimen was approved of.

9.—Mr. Robison presented a specimen of Seychelles Cotton, grown in his garden, from seed furnished by Mr. Palmer, to the Society, in 1830.

10.—Dr. Carey presented some Nankeen Cotton and Cotton Seed, grown in his garden at Serampore.

11.—Mr. Dobbs presented some Havannah Tobacco Seed, also some Chirimoya Seeds, in the name of Colonel Hezeta.—The thanks of the Meeting were offered to Col. Hezeta.

12.—Mr. Strong presented some Sea Island Cotton grown in Intally.

13.—Mr. McKean forwarded a quantity of Pernambuco Cotton grown at Duckinsore, near Calcutta, by Mr. Hastie, from seed furnished to the latter Gentleman by the Society.

The Secretary reported, that he received seven parcels of Silk, and twelve of Tobacco, from competitors; and an early day was therefore fixed, for a Meeting of the Committee of Prizes, and awarding the premium offered by Government.

#### 4.—NATURAL HISTORY SOCIETY OF THE MAURITIUS.

*Tuesday, 25th October, 1831.*

Mr. L. Bouton read a letter from M. J. Desjardins, addressed to the President, proposing that a request should be made to M. Lyall for the portrait of his father, their late colleague, Dr. R. Lyall: whereupon Mr. Charles Telfair, President, who was in possession of this picture, immediately tendering it as a boon, the Society accepted it with the liveliest acknowledgments.

The same party read also the Secretary's reply to the Baron G. Cuvier, expressive of the honor felt by the Society on the possession of his bust.

M. J. P. Goudot, cor. mem. Mus. Roy. of Paris, and travelling naturalist, was introduced by M. Faragnat, on the occasion of his arrival on a projected excursion to the isle of Madagascar. He offered to the Society a collection of the land shells of France, and of the environs of Palermo, in Sicily.

M. Leinard, sen. read the description of a new species of fish of the genus *aplocheilichthys* Cuv. which he names *A. capuchonné*. This is the third of the species existing in our seas. Commerson was the first to make it known in 1770. Upon the mention of this indefatigable naturalist several members again agitated the proposition of erecting a monument to his memory, and a subscription was instantly set on foot among the members present.

M. Lislet Geoffroy presented two Nos. of the *Journal des îles de France et de Bourbon*, 1786, containing remarks on *Nauscopie*.

The Society noted the publication of some of the papers read at its meetings, in the *Revue des annales des sciences naturelles* of December 1830. Also the abstract of their zoological researches in the *Jour. Zool. Soc.* of London.

Wednesday, 23d November, 1831.

M. Dalmas, of Bordeaux, Mr. James Calder, and Mr. James Irving, of Calcutta, were elected corresponding members.

The Secretary announced the death of three individuals in a way connected with the Society; Will. Roscoe, Esq. the Botanist: the Chevalier Aubert Du Petit Thouars, author of *Flore des îles australes de l'Afrique*: and M. Auguste Céré, native of the Mauritius, formerly Director of the Botanic Garden of Pamplemousses.

The Secretary read letters from Professor Quoy and the Baron de Ferussac, thanking the Society for the diplomas awarded them.

Also from M. Marcelin Sanzier, describing the eruptions of lava in Bourbon last July, and forwarding specimens.

Dr. Casanova announces that he is forwarding the Society's interests at Calcutta. Mr. Jules Verreau, member of the Cape of Good Hope Institution, offers his services as taxidermist.

Mr. V. J. Sganzin, Capt. Art. St Marie, Madagascar, was elected a corresponding member at Lorient. A collection of butterflies was presented in his name, containing particularly fine specimens of the *Uranie Riphée*.

M. Dalmas presented for the museum several *lusus naturæ*; weapons of the savages; and the skin of a lioness which died on the island.

M. Rob. de Chazal presented the model of an ancient monument at Rome, supposed to be the Sybil's temple.

The President presented two American serpents preserved in spirits, and Mr. B. Telfair a thick bamboo, the joints of which were covered with *anatifæ*, from the Savannah.

The following acquisitions to the library were announced.

*Hortus Indicus Malabaricus* of Von Rheed, 12 vols. fol.

*Herbarium Amboinense* of Rumphius, 6 vols. fol.

*Hooker's Botanical Miscellany*, one chapter.

A member read the description of two fish of the *Filous* genus, one of a reddish green, the other clear yellow, in other respects agreeing.

Another member read also the description of a fish which he believed to be a new species.

Mr. J. Desjardins read two short notices on the *libellule bordée* and the *libellule demi-transparente*, which are not found in the *Encyclopédie Méthodique*, and are thought to be new.



## VI.—European Intelligence.

*Results obtained from the Seed of the Mango.*

The mango tree, *Mangifera Indica*, L. has been transported from the East Indies to St. Domingo, and the other neighbouring islands, where it is now exceedingly abundant. In consequence of which, its products may now find useful applications; to forward which purpose, M. Arequin has devoted his attention to the analysis of the seed. The fruit is a fine mass of pulp, very agreeable in the estimation of some, and the seed or grain lies in the middle, having the form of a kidney, and inclosed in a parchment-like integument.

The mango pulp contains much crystallizable sugar, and also citric acid and gum.

The mango seed is remarkable for the large quantity of gallic acid present, and for the presence also of stearic acid, and for the useful state of its starch. When a seed is cut with a knife, it gives a deep blue color to the latter; when touched with persulphate of iron, it acquires a fine blue color, both effects due to gallic acid present.

Five pounds and a half of the seeds being worked upon, by various digestions in water, alcohol, &c. and subsequent evaporations, gave about eight ounces and a half of crystallized gallic acid.

When the pulp of the seeds had been exhausted by water, it was acted upon by alcohol, and a substance obtained by evaporation from the alcoholic solutions which crystallized, and had the following properties; it was perfectly white; was insipid and inodorous: if fused at 70° C. (158° Fahr.), on cooling, it crystallized in mingling long acicular forms; it is insoluble in water; it reddens moistened litmus paper; its solution in weak alcohol reddens infusion of litmus; it is quite soluble in oils and fatty bodies; it unites to salifiable bases, forming well characterized salts (soaps); when made into a taper, it burns like wax, with a fine white flame. This substance has all the physical and chemical characters of stearic acid, which therefore exists, ready formed, in the vegetable kingdom. Its quantity was rather more than two ounces.

When the pulp, thus far exhausted, was treated with æther, a fatty matter was obtained from it; fusing at 30° C. (86° Fahr.); soluble in hot æther to any extent; insoluble in rectified alcohol; liquifying in the mouth like cocoa butter; when formed into a candle, burning like tallow; having the consistence of tallow, and being of the same nature as the butter of cocoa. The powdered grain treated with water yields a small portion of this butter in a very pure and fresh state. The quantity obtained from the original quantity of seed was one ounce and a half.

After all these operations, the starch was separated by washing in water; its quantity amounted to 32½ oz. or rather more than half the weight of the dried seeds. When the recent seeds were worked with for starch, 1 lb. always yielded about 6 oz. of starch, and by drying lost about 6 oz. of water.

Besides these substances the following were also obtained; lignine, about 5 oz. gum, 2½ oz.; tannin, 200 grs. nearly; brown resin, 200 grs.; green resin, 144 grs. and a little vegetable albumen.

M. Arequin then describes processes for obtaining gallic acid from the mango seed, either with or without the use of alcohol, and for the preparation of ink with this substance instead of galls. If obtained in abundance, the seeds may be very useful for these and analogous purposes.—*Journal de Pharmacie*, 1831, p. 421.

### Catalogue of Indian Birds.

The following catalogue comprises, first, the collection taken home by Major James Franklin, F. R. S. &c. made during his tour up the Ganges between Calcutta and Benares, and in the Vindhyan range of hills between the latter place and Garra Mandela on the Nerbada : these are all numbered in the order of their systematical arrangement by the Secretary of the Zoological Society, as published in the proceedings of that body :—and, secondly, the collection of rare birds from the Himalayan mountains, presented to the Zool. Soc. by Mr. John Gould, A. L. S. most of them before undescribed. In characterizing the latter, Mr. Vigors points out the identity of a large proportion of their forms with those of northern Europe, observing that the elevation of their native mountains places them on an equality in point of climate with the birds of more northern latitudes. At the same time, he adds that many of the forms peculiar to southern Asia and the Indian Archipelago are found intermingled with those of the northern regions. Mr. Gould's birds will be recognized in the catalogue by their being unnumbered. A few Chinese birds will also be found classified with the rest, and indicated by the letter *C*. They were presented to the Zool. Soc. by H. H. Lindsay, Esq. of Canton, who procured them during the summer of 1830, in the neighbourhood of Manilla ; Mr. Vigors points out fifty new species, of which he has as yet only characterized a few. It must be a subject of regret that the native names were not inserted where it was possible to ascertain them, as that would have much enhanced the value of the catalogue to Indian naturalists. We are indebted to Dr. Warlow's kindness and industry for arranging the valuable materials in their present state, gleaned from the Journal of the Zoological Society's proceedings.

#### ORDO I. RAPTORES.

##### Fam. FALCONIDÆ.

##### Sub-Fam. *Aquilina*.—Genus *Aquila*.

1. *AQUILA VINDHIANA*. *Aq. pallide brunneo variegata ; capite, pectore, remigibus secundariis, caudæque saturatioribus, hujus apice albedo graciliter marginato ; remigibus primariis nigris ; capitis collique plumis pallido-rufis lanceolatis.*

Longitudo 26 unc.

Cawnpoor Eagle, Lath. ?

##### Sub-Fam. *Falconina*.—Genus *Hierax*.

- HIERAX ERYTHROGENYS*. *Hier. capite et corpore supra, caudæ femoribusque intense atris ; gula, collo in fronte, corporeque subtus albis ; strigæ a rictu ad aures extendente rufæ ; rostro albo, pedibus nigris.*

Statura *Hier. cærulescentis*.

Genus *Falco*.

2. *Falco Subbuteo*, Linn. *Hobby*, Penn. *Le Hobereau*, Buff.
3. *Falco Chicquera*, Daud. *Chicquera Falcon*, Lath. *Le Chicquera*, Le Vaill.
4. *Falco Tinnunculus*, Linn. *Kestrel*, Penn. *La Cresserelle*, Buff.

Sub-Fam. *Buteonina*.—Genus *Buteo*.

5. *Buteo Bacha*. *Falco Bacha*, Daud. *Bacha Falcon*, Lath. *Le Bacha*, Le Vaill.

BUTEO HOLOSPIUS. *But. supernè brunneus, subtilis brunnescentirufus; capite, fasciisque duabus remigum rectricumque fuscoatis; nuchâ et dorso, collo in fronte, pectore abdomineque toto, tectricibusque alarum maculis albis ocellatis, harum maculis diminutoribus.*

Staturâ tertiâ parte minor quàm *Buteo Bacha*; ei speciei simillima, differt tamen capite lævi, corporeque toto maculato.

Genus *Circus*.

6. CIRCUS TEESA. *Circ. capite corporeque rufo-brunneis, plumarum rhachibus fuscis; dorso imo, rectricibusque ferrugineis, his fasciis subobsoletis fuscis septem circiter notatis; remigum tectricibus abdomineque albescenti notatis; femorum tectricibus crissoque rufescenti-albis fronte, gulâ, nuchæque fasciâ gracili albis; rostro pedibusque flavis, illius apice nigro.*  
Longitudo 17½.  
*Zuggun Falcon*, Lath.?
7. *Circus cyaneus*. *Falco cyaneus*, Linn. *Hen Harrier*, Penn.
8. *Circus melanoleucus*. *Falco melanoleucus*, Gmel. *Black and white Indian Falcon*, Penn. *Le Tchoug*, Le Vaill.
9. *Circus rufus*, Briss. *Moor Buzzard*, Penn. *Le Busard*, Buff.

Sub-Fam. *Milvina*.—Genus *Elanus*, Savigny.

10. *Elanus Melanopterus*, Leach. *Le Blac*, Le Vaill.

Fam. *Strigidae*.—Genus *Otus*.

11. OTUS BENGALENSIS. *Ot. pallidè rufescens, fusco alboque undulatim variegatus; nuchæ pectorisque plumis in medio strigâ latâ brunneo-nigrâ notatis; abdomine fusco graciliter fasciato; remigibus rectricibusque lateralibus prope apicem brunneo fasciatis, his mediis per totum longitudinem similiter notatis.*  
Longitudo 20.  
Dr. Latham alludes to this as a variety of the *great-eared Owl*.

Genus *Noctua*.

12. NOCTUA INDICA. *Noct. cinereo-brunnea; capite guttis parvis albis, alis grandioribus notatis; abdomine albo, maculis brunneis lunulatis notato; remigibus rectricibusque albo fasciatis; regione circumoculari, gulâ, fasciâque subgulari, ad aures extendente albis.*  
Fœm. *magis rufescens, abdomine magis fasciatim maculato.*  
Longitudo 9.  
*Indian Spotted Owl*, Lath.?

NOCTUA CUCULOIDES. *Noct. brunneo-fusca; capite, dorso, tectricibus alarum, corporeque subtilis albo graciliter fasciatis; remigibus externè albo maculatis; rectricibus utrinque fasciis albis quique notatis; gulâ albâ.*

## ORDO II. INSESSORES.

## Tribus FISSIROSTRES.

Fam. *Meropidae*.—Genus *Merops*.

13. *Merops Philippius*, Linn. *Philippine Bee-eater*, Lath. *Grand Guépier des Philippines*, Buff.  
 14. *Merops viridis*, Linn. *Indian Bee-eater*, Lath. *Guépier à collier de Madagascar*, Buff.

Fam. *Hirundinidae*.—Genus *Hirundo*.

15. *Hirundo Klecho*, Horsf. *Klecho Swallow*, Lath. *Hirondelle longipenne*, Temm.  
 16. *HIRUNDO FILICAUDATA*. *Hir. supra purpurascens-atra, remigibus fuscis; corpore subtilis maculisque rectricum omnium lateralium albis; capitis vertice rufo; rectrice utrinque laterali elongato, ad apicem gracillimo.*  
*Statura Hir. riparia.*  
*Wire-tailed Swallow*, Lath.

17. *Hirundo riparia*, Linn. *Sand Martin*, Penn. *L'Hirondelle de rivage*, Buff.

Genus *Cypselus*.

18. *Cypselus affinis*, Hardw. *Allied Swift*, Hardw.  
 19. *Cypselus Pulmarum*, Hardw. *Balassian Swift*, Lath.

Fam. *Caprimulgidae*.—Genus *Caprimulgus*.

20. *CAPRIMULGUS MONTICOLUS*. *Cap. pallidi cinereo-brunneo, rufo, fuscoque sparsim variegatus; abdomine rufescenti-fusco fasciato; remigibus secundariis rufo nigroque fasciatis, primariis brunnescenti-nigris, quatuor externis fasciis latè albis in medio notatis; rectricibus sex mediis facies gracilibus nigris undulatis, duabus utrinque lateralibus albis apicibus brunneis.*  
*Fam. fasciis alarum rufis; caudæ concolori (sine albo).*  
*Longitudo 10.*

*Great Bombay Goatsucker*, Lath.?

21. *Caprimulgus Asiaticus*, Lath., Ind. Orn. *Bombay Goatsucker*, Lath.

- C. *CAPRIMULGUS MACROTIS*. *Cap. intensè brunneus, rufo undulatus, corpore subtilis caudique rufo fasciatis; capite aurito scapularibusque rufo-brunneis, fusco undulatis punctulatis nigroque notatis; torque jugulari albo ad nucham extendente rufo.*

*Longitudo corporis, 15; rostri ad frontem  $\frac{3}{4}$ , ad rictum, 1 $\frac{1}{4}$ ; alæ a carpo ad apicem remigis 2dæ, 10 $\frac{1}{2}$ ; caudæ, 7; tursi,  $\frac{1}{2}$ .*

Fam. *Halcyonidae*.—Genus *Alcedo*.

22. *Alcedo Bengalensis*, Gmel. *Little Indian Kingfisher*, Edw.  
 23. *Alcedo rudis*, Linn. *Black and white Kingfisher*, Edw.

*ALCEDO GUTTATUS*. *Alc. cristatus, supra ater, maculis rotundis albis guttatim notatus; subtus albus; colli lateribus pectoreque atro maculatis.*

*Statura Alc. maximi.*

Genus *Dacelo*.

- C. *DACELO LINDSAYI*. *Dac. corpore suprè brunneo, olivaceo et viridi nitente, guttis rufis-albidis notato, pectore abdomine crissoque albis, illorum plumis, mediis abdominis exceptis, olivascenti-viridi marginatis; capitis pileo saturatè olivascenti-viridi, vittâ-superciliari laezulinâ circumdato, deinde vittâ per oculos nigra, alterâque suboculari ferrugineâ marginato; gula juguloque ferrugineis; strigâ utrinque maxillari laezulinâ; remigibus fuscis; rectricibus omnibus ad apicem, duabus utrinque externis ad latera, ferrugineo notatis; rostro subbrevis.*

Longitudo corporis,  $10\frac{1}{2}$ ; rostri,  $1\frac{1}{2}$ ; alæ a carpo ad apicem remigis 3tiæ,  $4\frac{1}{2}$ ; caudæ,  $4\frac{1}{2}$ ; tarsi,  $\frac{1}{2}$ .

- C. DACELO LESSONII. *Dac. corpore suprà brunneo, olivaceo et viridi nitente, albido guttato; capitis pileo saturatè olivaceo-viridi, vittâ superciliari, cæruleo-viridi circumdato, deinde vittâ alterâ nigrâ marginato; collo in fronte corporeque subitè albo, pectoris abdominisque plumis viridi-brunneo marginatis; strigâ utrinque maxillari viridi; remigibus fuscis; rectricibus omnibus ad apicem, tribus utrinque externis ad latera, ferrugineo notatis; rostro sublongo.*

Longitudo corporis,  $11\frac{1}{2}$ ; rostri,  $1\frac{1}{2}$ ; alæ a carpo ad apicem remigis 3tiæ,  $4\frac{1}{2}$ ; caudæ,  $4\frac{1}{2}$ ; tarsi,  $\frac{1}{2}$ .

#### Genus Halcyon.

21. *Halcyon Smyrnensis*. *Alcedo Smyrnenis*, Linn. *Smyrna Kingfisher*, Lath. *Martin pêcheur de la côte de Malabar*, Buff.

#### Tribus DENTIROSTRES.

#### Fam. Muscicapidæ.—Genus Muscipapa.

25. *Muscipapa Banyumas*, Horsf. *Banyumas Flycatcher*, Lath. *Gobemouche Chantier*, Temm.  
 26. *Muscipapa nitida*, Lath., Ind. Orn. *Nitid Flycatcher*, Lath.  
 C. MUSCIPAPA OCCIPITALIS. *Musc. corpore supra pallidè lazulino, capite colloque splendidioribus; abdomine lazulino-albido; maculâ occipitali grandi, torquæque gracili jugulari, sericeo-atris.*

Longitudo corporis,  $6\frac{1}{2}$ .

#### Genus Muscipeta.

27. *Muscipeta Paradisi*. *Muscipeta Paradisi*, Linn. *Paradise Flycatcher*, Lath. *Gobe-mouche Tchitrec-be, roux et blanc*, Le Vaill.  
 28. *Muscipeta peregrina*. *Parus peregrinus*, Gmel. *Crimson-rumped Flycatcher*, Lath. *Gobe-mouche Oranor*, Le Vaill.

MUSCIPETA BREVIROSTRIS. *Mas. Musc. capite, collo, nuchâ, dorso superiori, alis, rectricibusque mediis splendenti-nigris; corpore infra, dorso imo, pteromatum apicibus, fasciâ remigum, rectricibusque lateralibus splendide coccineis; rostro brevi, subdebili.*

MUSCIPETA PRINCEPS. *Musc. capite, collo, dorso summo, alis, rectricibusque duabus mediis nigris; corpore inferiori, dorso imo, fasciâ latâ alarum, maculis paucis remigum secundariorum, rectricibusque lateralibus aurantio-coccineis; rostro fortiori.*

Longitudo circiter 9 uncias.

#### Genus Rhipidura.

29. *Rhipidura albofrontata*. *Rhip. capite colloque nigris; dorso cinereo-nigro; alis caudâque fusco-nigris; fasciâ subgracili frontali super oculos ad nucham extendente, pectore, abdomine, maculis tectricum alarum, apicibusque rectricum, duabus mediis exceptis, albis.*

Longitudo 6.

*White-browed Flycatcher*, Lath.?

30. *Rhipidura fuscoventris*. *Rhip. capite nigro; dorso abdomineque cinereo-nigris; alis caudâque fusco-nigris; strigâ brevi superciliari colloque in fronte albis; rectricum trium lateralium apicibus albescentibus.*

Longitudo  $7\frac{1}{2}$ .

*Broad-tailed Flycatcher*, Lath.?

**RIHIPIDURA NIGRITORQUIS.** *Rhip. cinereo-grisea; corpore subtilis, rectricumque, duabus mediis exceptis, apicibus albis; fronte, torquæque jugulari nigris; remigibus rectricibusque fuscis.*  
 Longitudo corporis, 7.

Fam. *Laniadæ*.—Genus *Ocypterus*.

31. *Ocypterus leucorhynchus.* *Lanius leucorhynchus*, Linn. *White-billed Shrike*, Lath. *Pie grièche de Manille*, Buff.

Genus *Edolus*.

32. *Edolus cærulescens.* *Lanius cærulescens*, Linn. *Fork-tailed Indian Butcherbird*, Edw.

Genus *Irena*.

- C. **IRENA CYANOASTRA.** *Ir. nigrescenti-cyanæa; capite suprâ, fuscâ tectricum alarum, uropygio, crissoque splendenti cyanæis; collo in fronte, genis remigibusque atris.*

Staturâ *Irenæ Puellæ*, et simillima; differt abdomine caudâque cyanæis, haud nigris, dorso cyaneo haud lazulino, et rostri culmine plus elevato.

Genus *Hypsipetes*.

- HYPSPITES PSAROÏDES.** *Hyps. capite supra suberistato, remigum apicibus, rectricibusque nigris; corpore alisque cineraceo-griseis; abdomine imo crissoque pallidioribus.*

*Rostrum pedesque flavi. Tectricum alarum remigumque pogonia interna fusca. Tectrices alarum inferiores cineraceo-griseæ. Longitudo corporis, 11½; alæ a carpo ad apicem remigis 3tise, 5; rostri 1; tarsi, ¾; caudæ, 4¼.*

Genus *Lanius*.

33. **LANIUS MUSCICAPÏDES.** *Lan. brunnescenti-cinereus subtilis albus; strigâ superciliari rufescenti-albâ; alis rectricibusque fusco-brunneis, his duabus lateraliibus albis basi notâque ad apicem fusco-brunneis.*

Fem. aut Mas. juv. *capite corporeque suprâ albedo maculatis.* Longitudo 6½. *Keroula Shrike*, Lath.?

- LANIUS ERYTHROPIERUS.** Mas. *Lan. nuchâ dorsoque griseis; capite supra, alis, caudâque atris; corpore subtilis, strigâ superciliari, remigumque apicibus albis; alis maculâ latâ rubrânotatis.* Fem. *Capite griseo; dorso, alis, rectricibusque virescenti-olivaceo notatis; harum apicibus flavis.*

Statura *Lan. Collurionis*.

Genus *Collurio*.

34. *Collurio Exceubitor.* *Lanius Exceubitor*, var. Linn. *Cinereous Shrike*, var. C. Lath.

35. *Collurio erythronotus*, Proceed. Zool. Soc. p. 42. *Grey-backed Shrike*, Lath.?

36. **COLLURIO NIGRICEPS.** *Col. capite suprâ, nuchâ, alis, caudâque nigris; guld, pectore, abdomine medio, maculâque in medio alarum, albis; dorso cinereo scapularibus, uropygio, abdominis lateribus, crissoque rufis.* Longitudo 8½. *Indian Shrike*, Lath.?

37. *Collurio Hardwickii*, Proceed. Zool. Soc. p. 42. *Bay-backed Shrike*, Lath.?

**COLLURIO HARDWICKII.** *Coll. capitis parte anteriore, strigâ per oculos ad collum extendente, alis, caudâque nigris; capitis vertice, corpore infra, maculâ media alarum, caudæ tectricibus, rectricibus duabus lateraliibus, catarrarumque, quatuor mediis exceptis, basi apiceque albis; occipite, nuchâ, dorsoque imo albescenti-griseis; dorso medio lateribusque abdominis ferruginis.*

*Rostrum* pedesque nigri. *Caput* supernè albo nigroque colore in duas ferè partes transversim divisum. *Longitudo corporis*, 8; *alæ* a carpo ad remigem 3tiā, 3½; *rostri*, ¾; *tarsi*, ⅞; *caudæ*, 3¾.

Bay-backed Shrike, *Lath. ? Gen. Hist. vol. 11. p. 13. sp. 6.*

This bird appears to be the same as that referred to in Dr. Latham's work, the description of which is taken from one of the drawings of General Hardwicke, to whom the species is inscribed.

**COLLURIO ERYTHRONOTUS.** *Coll. strigæ frontali per oculos ad medium colli extendente, alis, rectricibusque quatuor mediis nigris; capite supra, nuchâ, dorso superiori, rectricibusque lateralibus pallidè cinereis; corpore infra, alarum maculâ midâ, remigum interiorum apicibus, rectricum lateralium marginibus omniumque apicibus, albis; scapularibus, dorso imo, abdominisque lateribus ferrugineis.*

*Rostrum* pedesque nigri, illius mandibulâ inferiori ad basin flavescenti *Striga* per oculos nigra, supra graciliter albo marginata. *Tectrices* alarum inferiores albæ. *Longitudo corporis*, 10½; *alæ* a carpo ad apicem remigis 3tiæ, 3¾; *rostri* ⅞; *tarsi*, 1½; *caudæ*, 4½.

This bird was observed to bear a great resemblance to the description of the grey-backed Shrike of Dr. Latham, (*Gen. Hist. vol. ii. p. 9. sp. 3.*) but to differ from it in the colours of the lesser wing-coverts and tail; the former being all black in the Himalayan species, and blue grey, ending in pale rufous in Dr. Latham's; while the tail in the former species had four black middle feathers and the rest cinereous, but in the latter had the two middle ones only black, the rest being white. In a group exhibiting so much similarity in the disposition of the colours as the present, such differences are material as distinguishing species.

**COLLURIO TEPHRONOTUS.** *Col. fasciâ frontali pergracili ad medium colli per oculos latius extendente nigri; capite, nuchâ, scapularibus, dorsoque saturatius cinereis; collo anteriori pectoreque albescentibus, hoc fusco graciliter fasciato; abdomine crissoque ferrugineis; alis caudæque brunneo-fuscis, apicibus pallidioribus; dorso imo tectricibusque caudæ superioribus subrufescentibus. Tectrices alarum inferiores ferrugineo fuscoque notatæ. Statura paullo minor quàm in specie præcedenti.*

This bird also was observed to be closely allied to the last, and to differ from it probably only in sex or age. Until such points however could be ascertained, it was considered advisable to regard it as specifically distinct.

Genus *Graucalus*.

38. *Graucalus Papuensis*, Cuv. *Corvus Papuensis*, Gmel. *Papuan Crow*, Lath.  
Genus *Cebilepyris*.

39. *Cebilepyris cana*, Temm. *Muscicapa cana*, Gmel. *Ash-coloured Flycatcher*, Lath.

40. *Cebilepyris fimbriatus*, Temm. *Echenilleur frangé*, Temm.

Fam. *Merulidæ*.—Genus *Pitta*.

41. *Pitta brachyura*. *Corvus brachyurus*, Linn. *Short-tailed Crow*, var. B. Lath.  
*Short-tailed Pie*, Edw.

- LAMPROTORNIS PILOPTERUS.** Mas. *Lamp. supra plumbeo-canus, plumis ad apicem fusco marginatis; subtus albus, rufè tinctus; uropygio rufescenti; remigibus atris viridi splendidibus, maculâ alba; caudâ brunneâ; gullâ intensè rufâ.*

Fœm. *Supra pallidè brunnea, subtus albescens, brunneo tincta.*

Statura *Lamp. cantor.*

MYOPHONUS HORSFIELDII. *Myoph. cærulescenti-ater, fronte, humeris, marginibusque plumarum pectoris splendide cæruleis.*

Statura *Myoph. cyanei*, Horsf.

CINCLUS PALLASII, Temm. *Cincl. unicolor, intense brunneus, rostro pedibusque fuscis.*

Statura *Cincli aquatici*, Bechst.

#### Genus *Oriolus*.

42. *Oriolus Galbula*, Linn. *Golden Oriole*, Lath. *Le Lorient*, Buff.

43. *Oriolus melanocephalus*, Linn. *Black-headed Oriole*, Lath. *Lorient de la Chine*, Buff.

44. ORIOLUS MADERASPATANUS. *Or. fronte, corpore suprâ, tectricibus alarum abdomineque luteis; capite suprâ, genis, remigibus, notâque medianâ rectricum fusco-atris; guttâ albâ striis fusco-atris.* Longitudo 9.

*Oriolus Galbula*, var.  $\gamma$ . Lath. *Yellow Indian Starling*, Edw. *Yellow Starling from Bengal*, Albin.

C. ORIOLUS ACRORHYNCHUS. *Or. aureo-flavus; vittâ a tictu per oculos extendente sinciputque obtigente latâ, remigibus totis, rectricumque basibus nigris; rostro flavo, bulmine elevato.*

Longitudo corporis, 12; alæ a carpo ad apicem remigis 4tæ, 6; caudæ, 1½; tarsi, 1; rostri, 1½.

#### Genus *Turdus*.

45. *Turdus macrourus*, Gmel. *Long-tailed Thrush*, Lath.

46. *Turdus Saularis*. *Gracula Saularis*, Linn. *Pastor Saularis*, Temm. *Little Indian Pie*, Edw.

TURDUS PEGILOPTERUS. *Mas. Turd. corpore nigro, abdomine imo subcinerascenti-fusco; remigum mediarum pogoniis externis pteromatibusque cineraceo-griseis, his apice albis; rostro pedibusque flavis.*

Fœm.? *Corpore suprâ brunnescenti-griseo, subtilius pallidiori; pteromatibus remigumque mediarum pogoniis externis ut in mari notatis, sed colore subrufescenti tinctis.*

Statura ferè *Turdi Merulæ*, Linn.

A new species closely allied to the common European *Blackbird*, exhibiting the yellow bill and general black plumage of that bird, but differing from it in the varied markings of the wing.

CINCLOSOMA OCELLATUM. *Cinclos. capitis fronte et lateribus, corporeque suprâ rufo-brunneis; vertice, colloque in fronte nigro-brunneis; pectore abescenti-rufo nigro fasciato; abdomine pallidè rufo, nuchâ, dorso, alis, caudæque tectricibus ocellis anticè atris posticè albis, notatis; remigibus et rectricibus lateribus griseo-fuscis, apicibus albis.*

*Rostrum pedis que flavescentes, illius culmine fusco. Remigum mediarum pogonia externa grisea, strigam griscam exhibentes. Tectrices alarum inferiores rufo nigro abescentique variegatæ.* Longitudo corporis, 14; alæ a carpo ad remigis 6tæ apicem, 5; rostri, 3; tarsi, 1½; caudæ, 7.

[To be Continued]



*Register kept at the Surgeon General's Office, Calcutta, for the Month of June, 1832*

| Minimum Pressure<br>at 9th. 30m. |    |     |      |       |       |    |     |      |       | Max Temp. and Dryness<br>observed at 2h. 40m. |    |     |      |     |                        |     |      |      |     | Minimum Pressure<br>observed at 4h. 0m. |     |      |      |     |                            |     |      |      |     | Observations made at<br>sunset. |     |      |      |     |                       |     |      |      |     | Observations made at<br>at 11 1/2 P. M. |     |      |      |     |                        |     |      |      |     |                            |     |      |      |     |       |     |      |      |     |                       |     |      |      |     |                        |     |      |      |     |                        |     |      |      |     |                            |     |      |      |     |       |     |      |      |     |                       |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |  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| Depress. of<br>M.B. Ther.        |    |     |      |       | Wind. |    |     |      |       | Aspect of<br>the sky.                         |    |     |      |     | Barom.<br>red. to 32°. |     |      |      |     | Temper.<br>of the air.                  |     |      |      |     | Depress. of<br>M. B. Ther. |     |      |      |     | Wind.                           |     |      |      |     | Aspect of<br>the sky. |     |      |      |     | Barom.<br>red. to 32°.                  |     |      |      |     | Temper.<br>of the air. |     |      |      |     | Depress. of<br>M. B. Ther. |     |      |      |     | Wind. |     |      |      |     | Aspect of<br>the sky. |     |      |      |     | Barom.<br>red. to 32°. |     |      |      |     | Temper.<br>of the air. |     |      |      |     | Depress. of<br>M. B. Ther. |     |      |      |     | Wind. |     |      |      |     | Aspect of<br>the sky. |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |     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| 12.3                             | s. | cl. | 5.12 | 1003. | 16.1  | s. | cu. | 4.18 | 100.5 | 13.   | s. | cu. | 4.12 | 9.5 | 8.3                    | cl. | 5.13 | 84.8 | 3.2 | s.                                      | cu. | 5.73 | 84.8 | 3.2 | s.                         | cu. | 5.73 | 84.8 | 3.2 | s.                              | cu. | 5.73 | 84.8 | 3.2 | s.                    | cu. | 5.73 | 84.8 | 3.2 | s.                                      | cu. | 5.73 | 84.8 | 3.2 | s.                     | cu. | 5.73 | 84.8 | 3.2 | s.                         | cu. | 5.73 | 84.8 | 3.2 | s.    | cu. | 5.73 | 84.8 | 3.2 | s.                    | cu. | 5.73 | 84.8 | 3.2 | s.                     | cu. | 5.73 | 84.8 | 3.2 | s.                     | cu. | 5.73 | 84.8 | 3.2 | s.                         | cu. | 5.73 | 84.8 | 3.2 | s.    | cu. | 5.73 | 84.8 | 3.2 | s.                    | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 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| cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 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3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84.8 | 3.2 | s. | cu. | 5.73 | 84 |

# JOURNAL

OF

## THE ASIATIC SOCIETY.

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*No. 7.—July, 1832.*

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*I.—Translation of a Tibetan Fragment, by Mr. Csoma de Körös, with remarks by H. H. Wilson, Secy.*

(Read, July 4th.)

In the 9th volume of the Gyut class of the Kahgyur occurs the original of a Tibetan fragment, which created in the beginning of the last century a lively sensation amongst the learned men of Europe, and the history of which furnishes an amusing instance of the vanity of literary pretensions, and of the patience and pain with which men of talent and erudition have imposed upon themselves and upon the world.

In the end of the 17th and beginning of the 18th century, the Russians in their incursions into Siberia came upon various deserted temples and monasteries, in some of which considerable collections of books were deposited. These were in general destroyed or mutilated by the ignorant rapacity of the soldiery, but fragments of them were preserved, and found their way as curiosities to Europe.

Amongst these, some loose leaves, supposed to have been obtained at the ruins of Abilaikit, a monastery near the source of the Irtish, were presented to the emperor Peter the Great. Literature being then at a low ebb in Russia, no attempt was made to decypher these fragments, and they were sent by the Czar to the French Academy, whose sittings he had attended when at Paris, and who deservedly enjoyed the reputation of being the most learned body in Europe. In 1723, the Abbé de Bignon, on the part of the Academy, communicated to the Czar the result of their labour, apprising him, that the fragments sent were portions of a work in the Tibetan language, and sending a translation of one page made by the Abbé Fourmont with the help of a Latin

and Tibetan Dictionary in the Royal Library. The letter was published in the Transactions of the Academy of St. Petersburg, and the text and translation reprinted by Bayer in his *Museum Sinicum*. Müller in his *Commentatio de Scriptis Tanguticis in Siberiâ repertis*—Petropoli, 1747, criticised Fourmont's translation, and gave a new one of the first lines, prepared with the double aid of a Tangutan priest, or Gelong, who rendered it into Mongol, and a Mongol student of the Imperial College, who interpreted that version to Müller. The original was also engraved in the Transactions of the Leipsic Academy. It was reprinted with corrections and additions and a new translation by Giorgi in his *Alphabetum Tibetanum*, and has recently been made the subject of animadversion by Mons. Remusat, in his *Recherches sur les Langues Tartares*. Of the previous performances, M. Remusat thus speaks : " On avoit d'abord admiré la profonde erudition qui avoit permis à Fourmont de reconnoître seulement la langue dans laquelle le volume étoit écrit : on a vanté depuis celle de Giorgi, qui avoit rectifié et le texte et la traduction. Je ne sais comment on peut traduire ou corriger un texte qu'on n'est pas même capable de lire. Il n'y avoit rien d'admirer dans tout cela : interprètes et commentateurs, panegyristes et critiques tous étoient presque également hors d'état, je ne dis pas d'entendre une ligne, mais d'épeler une syllabe du passage sur lequel ils disertoient.

The consequence was what might have been expected, and the attempts at translation and correction were most ludicrously erroneous. The greatest liberties possible were taken with the words, and letters were inserted or omitted at pleasure, in order to make them approximate to those terms which appeared most like them in the imperfect dictionaries possessed by the translators. After all, the translation was not only unlike the original, but unlike common sense ; and as was remarked of Fourmont's version by the President de Brosses, the Latin was quite as unintelligible as the Tangutan. The following specimens of the first lines of the different versions will show that the remark was applicable to all as well as to the first.

*Fourmont's Translation.*

" Attritâ fortitudine quisnam brevis equus frigoris vita destruat (pro) spiritu inest putredo. Contritus oratne? hoc est irrisio omnes vident : orat avis contrita? morbida? non scit (non potest amplius) os aperire legis (ratiocinationis)."

This must have puzzled the Czar and his academy quite as much as the original ; and as Remusat observes, the Latin was of marvellous use to the translator. Fourmont would not have dared to write a syllable of such nonsense in French.

The manner in which Fourmont was led to such a strange misrepresentation of the original is explained by Mons. Remusat, from whom we may take one instance as a specimen—Thus of the word *brevis equus*. The MS., M. Remusat says, was read by Fourmont *Tsru pá té*, (Mr. Csoma has *ch'hud-pá-des*.) He found in the Dictionary *chung-pá* signifying 'short' and *r-ta* meaning 'a horse', and these being the nearest approach to the syllables before him, he adopted as essentially the same, and rendered them accordingly.

*Müller's Translation.*

"Firma conscientiâ mediante omnia parvi pendendo in principio vivente cuicumque auxilium oritur inde. Quibus consummatis futurum quid nemini notum est. Religio tota namque religionis explicatio. Magnates autem intellectu (suo) ea non comprehendunt."

The matter has not been made much more distinct by the aid of the Tangutan monk and Mongolian student.

*Giorgi's Translation.*

"Misericordia recreat et a cruciatibus absolvit Summus protector viventes omnes qui eam adoratoribus suis revelat. Benefici largitoris virtutem sciunt omnes, sed orationis invocationisque vim et efficaciam exponere et aperire nesciunt: nomen ea exprimit arcanum illius legis quæ lex est spirituum, &c."

How far either of these expresses the sense of the opening of this fragment, may now be duly appreciated by the perusal of the following.

*Mr. Csoma's Translation.*

[*Chom dan dás*] "addressed his mind to meditation upon the affairs of animate existences. The ignorant do not perceive the moral signification of moral things."

Not a word of this appears in the preceding versions. Its accuracy speaks for itself; but in confirmation of its correctness, the original Tibetan, both in Tibetan and Roman characters, is here reprinted, as well as the translation of the entire passage. Those to whom the prosecution of the subject is of interest may readily estimate for themselves the superiority of Mr. Csoma's labours, by comparing them at length with the text and translations of Fourmont and Giorgi in the *Alphabetum Tibetanum*.

Before proceeding to the new translation, however, a few further remarks upon the subject of the old are necessary.

The Society is apprised of the general character of the contents of the Gyut portion of the *Kahgyur*, to which our original belongs, and will not be surprised, therefore, to learn that a great part of the extract consists of Mantras, or mystical formulæ, or invocations, and these not

in Tibetan but in Sanscrit. Now, neither of the former translators had any knowledge of Sanscrit, nor was aware that these passages were in that language. Fourmont considered them to be Tibetan, as well as the rest, and very deliberately translated the Sanscrit words with the help of his Tibetan Dictionary. As he could not find the exact words, however, he was content to take those most like them; and at the expense of a few letters omitted or inserted, he contrived equivalents for the *mantras* equally satisfactory with those he had devised for the other sentences of his text. Thus he converts the Mantra *Nama Sāmantha Buddhānam, Sāmantanugate, varaja, Dharmannirgata, Mahā Mahā Svāhā*, into *Na-ma Sum-tam Pou-tra Nan-hi-tsi cha-ya r-pa sa-n-ha*, which he translates, “Ægrotavit (restitit morbo) Samtam pou-tra per annum dum hujus mundi evanesceret, &c.” The same importing, as far as such things admit of being translated, “Salutation to the chief *Buddhas*. Obtainer of pre-eminence; best born; who proceeded from virtue. Great great adoration.”

Giorgi is more upon his guard, and discovers that the *mantras* are not in ordinary Tibetan. He has no suspicion however of their real character, and calls them magical expressions. He prints them therefore without any translation, but nevertheless pretends to explain their purpose in his notes on the text, in which he assembles a crude mass of extravagancies from Hebrew, Chaldaic, Coptic, and Syriac, and compares these Tibetan characters to the mystic numbers and letters of the ancient Scythians and Egyptians, and of some of the early Sectarians and Heretics of the Christian Church. This display of unprofitable erudition is in fact only a shelter for his ignorance, and he knows no more about the matter than did Fourmont, without having the merit of his blundering simplicity.

We shall now proceed to the translation.

*Translation of an Extract from the T. or 9th volume r, Gyut class of the Kāh-gyur, the 337—339 leaves.*

Ignorant men do not know that all these (doctrines) have been thus explained by *Chom dan dās* (the Supreme), the knower of all and possessor of all, who in remote ages, through compassion for all living beings, addressed his mind to meditation upon the affairs of animate existences. (a Stanza) The ignorant do not perceive the moral signification of moral things. It has been distinctly taught (by *Buddha*), that the essential principle of morality is the non-entity of matter.

The performer of mystic rites must always dwell upon that idea, and discharge his duty accordingly.

This was a gradual and comprehensive explanation of the means by which noxious things (or evil spirits) may be appeased.

• Then CHAKNA DORJE (S. VAJRAPĀNI) and other *Dorje* bearers, (*Vajradharas*, bearers of thunderbolts), KUNTU-ZANGPO (SĀMANTA BHADRA), and other *Chang chub sempās* (Bodhisatwas) having adored *Chom dān das*, NAM PAR-SNANG-DSAT (the Bhagavān or Lord VAIROCHANA), being desirous to express each in his own *mantra* or invocation, his mystic praise, and how they judged in this great circle the source of infinite mercy, of the pure way of access to the root of all things, requested permission from CHOM DAN DAS.

Then CHOM DAN DAS having granted them permission, and bestowed his benediction upon them, thus spake, “Illustrious children, accordingly as you judge of the root of things (the first moral being), utter your mystic sentences for the purification of all animate existence.”

Then the Bodhisatwa KUNTU ZANGPO, being immersed in that profound meditation, which is called the region of the ornamental (characteristic) of a Buddha, uttered this mystical sentence (mantra) of irresistible efficacy.

Nama Sāmanta Buddhānam, &c. Glory to the exalted Buddhas ! obtainer of eminence ; best born ; who proceedest from virtue—great, great adoration. This is the mantra of KUNTU ZANGPO.

[For the rest of this, and for the Sanscrit of the other Mantras, see the passages in Italics in the Tibetan extract in Roman character ]

Then the Bodhisatwa CHAMPA (MAITREYA) after being immersed in the profound meditation called “the universally manifested beneficence,” thus uttered his own radical prayer (*vija mantra*), *Numa Sāmanta Buddhānām*, &c. Glory to the exalted Buddhas ; conqueror of the invincible ; possessor of the fame of all purity—adoration. This is the prayer of CHAMPA.

Then the Bodhisatwa NAM-KHE NYING PO (ĀKĀŚA GERBHĀ) being immersed in the profound meditation called “the purest region,” uttered through mystery, Glory to all the Buddhas ; wonderful holder of blessings ; who art possessed of equal elevation with the heavens—salutation. This is the prayer of NAM-KHE NYING PO.

Then the Bodhisatwa GRIPPA THAM CHET NAM-PAR SELVA (S. Sarva Anavarana Vishkambhi) being immersed in the meditation, called “the power of great mercy,” uttered his mystery, Glory to the exalted Buddhas ; thou who art not separated ; connected with the Aswattha tree. *Trām Trām, Rām Ram*—salutation.

[This is one of the Mantras, of which there is no making any sense ; some allusion is implied probably, a knowledge of which is necessary to explain the words. The concluding syllables are merely ejaculatory monosyllables.]

Then the Bodhisatwa KUNTU CHENRESIK VANGCHUK (S. AVALOKITESVARA) being immersed in the meditation called (after him) KUNTU CHENRESIK, or "looking every where with clear vision," thus together with his followers uttered his own radical mystery, Glory to the exalted Buddhas: universal *Tathāgata*, AVALOKITA; abounding with clemency—Ra-ra-ra-hum-jah—salutation. This is the mantra of CHENRESIK.

Glory to the exalted Buddhas, Jang-jang sa,—salutation. This is the mantra of THU-CH HEN T'HOP (S. MAHA ŚT HANA PRĀPTA).

Glory to the exalted Buddhas; offspring of clemency, TÁRÁ, by whom existence is traversed—salutation. This is the Mantra of the LIHAMO GROL MA, (the goddess TÁRÁ.)

Glory to the exalted Buddhas: frightener of every fear. Hum, Sphtaya—salutation. This is the mantra of Kronyer Chen Má (S. Bhrikuti.)

Glory to the exalted Buddhas: born from all the *Tathāgatas*; decorated with a chaplet of Lotus flowers—salutation. This is the Mantra of Kos Kar Chen (S. PĀNDURA VĀSINĪ), the goddess clothed in white garments.

Glory to the exalted Buddhas: Hum-Eat-bind-*Sphtaya*. This is the Mantra of a *Ta-grin*. (S. *Kinnara*.)

Then the Bodhisatwa SAHI NYING PO (S. KSHITI GERBHA) being immersed in the meditation called "the region of reasoning," uttered this mystery, Glory to the exalted Buddhas, Ha ha-ha Putanu—salutation. This is the mantra of SAHI NYING PO.

Then the Bodhisatwa JAM-PAL ZHON NUR GYURZH PA (S. Manju Sri KUMARA BHATTA BHUTA) being immersed in the deep meditation called "the miraculous transformation by the blessings of Buddha," thus uttered his own radical mystery, Glory to the exalted Buddhas. He-he-he, the young prince, Liberation. Communion.—Remember, remember, resist. Swaha. This is the Mantra of Jam-pal.

Then CHAKNA DORJE (S. VAJRAPĀNĪ), the lord of those who deal with mysteries, being immersed in the deep meditation called "the invincible," thus uttered together with his followers his own radical mystery, Glory to the exalted *Vajras*, fierce and greatly wrathful. Hum. This is the mantra of CHAKNA DORJE.

(Similar mantras by the goddess MĀMAKĪ and five others follow, occupying three lines).

Then the Lord SAKYA THUP-PA (MUNI) being immersed in the deep meditation called "the mine of precious things," thus with his attendants uttered his own mystery, Glory to the exalted Buddhas; reliever

of all distress ; master of all virtue. Equal, equal to the heavens—salutation. This is the Mantra of SAKYA THUP-PA).

. (Similar mantras are continued through the following page of the same leaf.)

*The Tibetan Text in Roman Character.*

NOTE.—The letters in italics at the commencement of any syllable, are omitted in the pronunciation. The Sanskrit passages or *mantras* are printed in italics.

Mi blun po dé dag gis hdi ltar bchom-ltan-hdas thams chad mkhyen pa chhos thams chad la mñ ah brn yes pa Sems chan gyi don thogs “\*par thugs su chhud pa dës sñon sems chan rnam la phan par Bzhed nas hdi dag thams chad bshad do zhes bya var ni mishes so.

Chhos rnam kyî ni chhos kyî mts’han bLun po dës ni dé mi shes ; Chhos rnam kun gyi mts’han nyid ni, stong pa nyid du yang dag gsungs sñags pa rtag tu der gnas nas, rab tu ñes par las byaho. Bgegs zhi var bya va rim par phyé vá sté rgyas paho.

Dé-nas phyag na rdo rjé la sogs pa rdo rjé hdsin pa dé dag dang Kun tu bzang po la sogs pa byang chhub sems Dpah di rnam kyis bchom-ltan-hdas rnam-par-s nang-mdsad la phyag hts’hal nas snying rjé chhen po hbyung vahi dkyil lkhor chhen po hdir chhos kyî dvyings rnam par dag pali Sgo ji ltar rtogs pa rang rang gi ts’hig tu brjod pahi ts’hig gis gsang sñags rnam smra var ldod nas bchom-ltan-hdas la gsol va btab po dé nas bchom-ltan-hdas rnam par nang mdsad kyis byang chhub sems dpah dé dag dang rdo rjé hdsin dé dag la mi nyams pahi chhos nyid du byin gyis brlabs nas bkah stsal pa : Rigs kyî bu dag chhos kyî vyings ji ltar rtogs pa bzhi sems chan gyi kham rnam par sbyang vahi gsang sñags kyî ts’hig rnam smros-srig.

Dé-nas dé-hi ts’hé byang chhub sems Dpah Kun tu bzang pos sangs rgyas kyî yul zhes bya vahi ting gé hdsin la snyoms par zhugs nas Stobs thogs pa med pahi gsang sñags smras pa : *Namuh Samanta Buddhânâm ; Samantânugatî Varaja, Dhermanirgata, Mahâ Mahâ. Svâhâ.* Kun tu bzang po hiho.

Dé-nas byang chhub sems dpah byams pas byamspa chhen po kun tu mñon par hbyung va zhes bya vahi ting gé hdsin la snyoms par zhugs nas rang gi snying po smras pa : *Namuh Samanta Buddhânâm, Ajitanajaya, Sarva Satwayushayânugata, Svâhâ.* Byams pahi ho.

Dé-nas byang chhub sems dpah nam mkhahi snying po rnam par dag pahi yul zhes-bya vahi ting gé hdsin la snyoms par zhugs nas gsang sñags smras pa : *Namuh Samanta Buddhânâm, A’kûsha somatânugata Vichitram Varadhara, Svâhâ.* Nam mkhahi snying pahi ho.

\* The Tibetan fragment of Giorgi commences here.



Dé-nas byang-chhub sems dpah sgrib pa thams chad rnam par sel va Snying rjé chhen pohi Stobs zhes bya vahi ting gé hdsin la snyoms par zhugs- nas gsang sñags smras pa : *Nama Samanta Buddhánám, A'saáda hrita, Aryudgata, Trám Trám, Ram, Ram, Swáhá.* Sgrib ba thams chad ruampar sel vahi ho.

Dé nas byang chhub sems dpali kun tu spyen ras gzigs dvang phyug spyen ras gzigs zhes bya vahi ting gi hdsin-la snyoms par zhugs nas rang gi snying po hkhor dang bhas par smras pa : *Namah Samanta Buddhánám, Sarva Tathágata, Avalokita, Karaná, Mâyá, Ra Ra Ra. Hum jah, Swáha.* Spyen ras gzigs dvang phyug gi ho.

*Namah Samanta Buddhánám, jang jangsa, Swáhá.* Mthu-chhen-thob pali ho.

*Namah Samanta Buddhánám, Karimodbhavé Túrí Turáni, Swáhá.* Lhá mo sgrol ma hi ho.

*Namah Samanta Buddhánám, Sarva Bhaya Trásuá Hum spho'taya, swáhá.* Khro G,nyer chan mahi ho.

*Namah Samanta Buddhánám, Tathágata Vishwayá, Sambavé, Palma málini, Swáhá.*

Gos dkar-chan gyi-ho. *Namah Samanta Buddhánám, Hum khada bandha spho'taya, Swáhá.* RTa Ngrin gyi ho.

Dé-nas byang chhub sems dpah-sahi snying po rdo rje mi shigs pa r,tog pali yul zhes bya vahi ting gé hdsin las snyoms par shugs nas gsang sñags smras pa : *Namah Samanta Buddhánám Ha Ha Ha, Putánu, Swáhá.* Sahi snying pali ho.

Dé-nas byang chhub sems Dpah hjam dpal gzhon nur gyur pas sangs rgyas kyi byin gyis brlabs rnam par hphrul pa zhes bya vahi ting gé hdsin la snyoms par zhugs nas rang gi snying po smras-pa : *Namah Samanta Buddhánám, Hé Hé Hé, Kumaraku, Vinukti, Sathérthati, S mara smara, Prathihana, Swáhá.* Hjam dpal gyi ho.

Dé nas gsang va pali bdag po Phyag na rdo rjé mi hpham pazhes bya vahi ting gé hdsin la snyoms par zhugs nas rang gi snying po hkhor dang bhas pa smras pa : *Namah Samanta Vaj'ránám, Chánda Máhá\** Ros'hana Hum. Piyakna rdo rjéhi ho.

\* \* \* \*

Dé-nas déhi ts'hé. Chom-ldan-hdas Shákya Thub pas rin po chhehi hbyung gnas zhes bya vahi ting gé hdsin la snyoms par zhugs nas nyid kyi snying po hkhor dang bhas pa gsungs pa : *Namah Samanta Buddhánám, Sarva klésha nishuddhána, Sarva Dherma vahi prapta, Gagana sama sama, swáhá.* Shákya Thub pali ho.

\* Giorgi's fragment ends here in the middle of the word *mahá*, the remaining passage is added to complete the sense.

མི་སྤྱོད་པོ་དེ་དག་གིས་འདི་ལྟར་བཅོམ་ལྟན་འདས་ཐམས་ཅད་  
 མཆིལ་པ། ཚེས་ཐམས་ཅད་ལ་མཇུག་བརྟེན་པ། སེམས་ཅན་གྱི་དོན་  
 རྟགས་༥ བར་བྱུགས་སུ་རྒྱུད་པ་དེས་སྟོན་སེམས་ཅན་རྣམས་ལ་  
 བཞུ་པར་བཞེད་ནས་འདི་དག་ཐམས་ཅད་བཞུད་དོན་གྱིས་ཀྱང་  
 བར་ཞི་མོལ་སོ། ། ཚེས་རྣམས་ཀྱི་ཐོ་ཚེས་ཀྱི་མཚན། ། ལྷུན་པོ་  
 དེས་ཞི་དེ་མི་གས། ། ཚེས་རྣམས་ཀྱུན་གྱི་མཚན་ཉིད་ཞི། ། ལྟོད་  
 པ་ཉིད་དུ་ཡང་དག་གསུངས། ། ལྟུགས་པ་རྟག་དུ་དེར་གསུངས་  
 བས། ། རྟག་དུ་དེས་པར་ལས་ཀྱི། ། བཞུགས་ཞི་བར་ཀྱང་བ་  
 རིམ་པར་སྟེ་བ་སྟེ་རྟེན་པར། ། དེ་ནས་ཀྱུན་ནང་དེ་ཕྱི་ལོགས་  
 པ་དེ་རྩེ་འཇོག་པ་དེ་དག་དང་ཀྱུན་དུ་བཟང་པོ་ལ་སོགས་པ་ཀྱང་  
 རྒྱུ་མ་སེམས་དཔའ་དེ་རྣམས་ཀྱིས་བཅོམ་ལྟན་འདས་རྣམས་  
 པར་སྤྱད་མཇུག་ལ་ལྟུགས་འཚལ་བས། ལྟོད་རྩེ་ཆེན་པོ་འཇུག་  
 བའི་དཀྱིལ་འཁོར་ཆེན་པོ་འདིར་ཚེས་ཀྱི་དཀྱིལ་སྤྱོད་པར་  
 དག་པའི་སྟོན་རྩེ་རྟགས་པ་རྟེན་གྱི་ཆོས་དུ་བཞུགས་པའི་ཆོས་  
 གསེ་གསལ་སྤྱུགས་རྣམས་སྤྱོད་བར་འདོད་ནས་བཅོམ་ལྟན་འདས་  
 ལ་གསོལ་བ་བཏབ་པོ། ། དེ་ནས་བཅོམ་ལྟན་འདས་རྣམས་  
 པར་སྤྱད་མཇུག་ཀྱིས་ཀྱང་རྒྱུ་མ་སེམས་དཔའ་དེ་དག་དང་།  
 རྩེ་རྩེ་འཇོག་དེ་དག་ལ་མི་རྣམས་པའི་ཚེས་ཉིད་དུ་ཀྱུན་གྱིས་  
 བརྟེན་བས་ནས་བཞུད་སྤྱུང་བ་ ། རྟགས་ཀྱི་སྤྱོད་དག་ཚེས་ཀྱི་



དུངས་ཇི་ལྟར་རྟོགས་པ་བཞི་ལོ་མས་ཆུ་ཉི་ཁམས་རྣམ་པར་  
 ལྟོད་བཤི་གསལ་ལྟགས་ཉི་མེ་རྣམས་སྒྲིབ་གཤི། དེ་ནས་དེ་ལྟེ་  
 གུང་རྒྱལ་སྐམས་དཔའ་ཀྱུན་ཏུ་བཟང་པོས་སངས་རྒྱལ་ཉི་མེ་  
 ཉི་ལྷལ་ཞེས་ཀྱང་བཤི་རྟེན་དེ་འཇོལ་ལ་སྒྲིབས་པར་བྱགས་ནས་  
 སྒྲིབས་ཐོགས་པ་མེད་པའི་གསལ་ལྟགས་སྒྲིབས་པ། བ་མཆོས་ལྟོ་  
 རུང་རྟུ་ལ། ས་མ་རྟུ་ལ་ཉི་བ་ར་ཇི་རྟུ་ལ་ཇི་རྟུ་ལ་རྟུ་ལ་རྟུ་ལ་  
 སྒྲིབ་རྟུ་༥ ༥ ཀྱུན་ཏུ་བཟང་པོ་ལོ༥ དེ་ནས་གུང་རྒྱལ་སྐམས་  
 དཔའ་གུམས་པས་གུམས་པ་ཆེན་པོ་ཀྱུན་ཏུ་མཇོན་པར་  
 རུང་བཞེས་ཀྱང་བཤི་རྟེན་དེ་འཇོལ་ལ་སྒྲིབས་པར་བྱགས་ནས་  
 རང་གི་སྒྲིབ་པོ་སྒྲིབ་པ། བ་མཆོས་ལྟོ་རུང་རྟུ་ལ། ལ་ཇི་རྟུ་  
 བཇོ་ལ། ས་རྟུ་ལ་ཉི་བ་ལ་ལྟོ་ལ་རྟུ་ལ་རྟུ་ལ་གུམས་པའི་  
 ལོ། དེ་ནས་གུང་རྒྱལ་སྐམས་དཔའ་རྣམ་མཁའི་སྒྲིབ་པོ་  
 རྣམ་པར་དག་པའི་ལྷལ་ཞེས་ཀྱང་བཤི་རྟེན་དེ་འཇོལ་ལ་  
 སྒྲིབས་པར་བྱགས་ནས་གསལ་ལྟགས་སྒྲིབས་པ། བ་  
 མཆོས་ལྟོ་རུང་རྟུ་ལ། ལྟོ་ལ་ལ་ལ་ལ་རྟུ་ལ་རྟུ་ལ་རྟུ་  
 ལོ་ལྟོ་ལ་རྟུ་ལ་སྒྲིབ་རྟུ་ལ། བམ་མཁའི་སྒྲིབ་པོ་ལོ༥ དེ་  
 རྣམ་གུང་རྒྱལ་སྐམས་དཔའ་སྒྲིབ་པ་ཐམས་ཅད་རྣམ་  
 པར་སེལ་པ། སྒྲིབ་རྟེ་ཆེན་པོ་སྒྲིབས་ཞེས་ཀྱང་བཤི་  
 རྟེན་དེ་འཇོལ་ལ་སྒྲིབས་པར་བྱགས་ནས་གསལ་ལྟགས་













**II.—*Estimate of the Risk of Life to Civil Servants of the Bengal Presidency in each year of their Residence in India.* By H. T.**

• **Prinsep, Esq. Secretary to Government, &c. &c.**

The Number of the GLEANINGS IN SCIENCE for September, 1831, contained an article "On the Duration of Life in the Bengal Civil Service" with several tables, exhibiting the results at which the author had arrived by various processes of calculation. The subject is of first-rate interest to all residents in India, and the manner in which these tables have been given forth is likely to lead to their being taken upon trust as of full authority. The results however are too startling to be admitted without a strict examination of the data, which are the basis of calculation; and as the registers and statements from which these profess to be taken were compiled principally in my office, and have recently been brought to more accuracy than they possessed when first prepared and furnished to the Finance Committee, and to other departments and public officers, I have thought it my duty to recast them myself into a tabular form, so as to allow the results afforded by them to be compared with those assumed in the article in question. I am sorry to say, that they differ too widely to be adjusted by any compendious explanation of discrepancies; and, as I have found reason moreover to doubt whether any accurate conclusions can be drawn from the specific results which are there exhibited as the basis of calculation, I am compelled to adopt somewhat different forms. For these reasons, no less than for assurance, that the data have not been lightly assumed, my first table has extended to a size and contains a quantity of detail which may prove inconvenient.

It is necessary to premise that the materials we possess are: first, the appointments made in each year by the Honorable Court of Directors. Secondly, the arrivals in India under these appointments; which are necessarily irregular in date, and not equal in number with the nominations. Thirdly, the retirements; which is rather a wide class, including as well those who absolutely resign, as those who leave the country upon temporary leave, and overstay the period of five years fixed by Act of Parliament as the limit for absence from India without loss of the service. Civil Servants on Furlough, or in Europe, under temporary leave, being still borne on the registers, and their deaths being reported, are considered as still in the service, and though dying perhaps in Europe or on shipboard would be entered amongst the deaths. The dismissals from service are included in the head of Retirements. Fourthly, Deaths; the reports of which, with the dates, are ordinarily on record;

or, if not so, the time can be ascertained with sufficient accuracy by a reference to the books of the General Treasury, which show up to what date salary has been drawn and arrears adjusted with executors. Deaths on shipboard, when not reported, are considered as of the year in which the ship left India.

From the above materials, the Court's annual list of appointments being taken as a ground-work, every individual name has been traced, and the fate of the person who bore it, ascertained to the time of his death, or of his quitting the service. The following statement exhibits the result in one view with the date by the calendar year of each death or retirement. If any one should desire to know the names of the individuals represented by the figures of this table, that information also is at his service in the registers that have been compiled, together with the specific ground of placing in each instance. Our present business however is with the results in abstract.

This table corresponds with that of page 273 in the article of the *GLEANINGS* referred to, only so far as that the number of appointments between 1790 and 1828 will be found to be the same. The number here is 842, to which add 11 for those who never came to India under their appointments, as noted at the foot of the table. The writer of the article assumes 852\*, showing that he has followed the same registers without rejecting the non-arrivals, which, for the correct ascertainment of the proportion of deaths, should evidently have been done. The table requires to be well studied and examined, before we proceed to make deductions from the data it contains. The test or verification of its accuracy will be found in the last column, which gives the remaining servants of each year, that is, those still in the service, after deducting the deaths and retirements, up to the date of compilation, from the number of original appointments. See Table No. I.

Now, the first thing to be remarked in this table is, that the appointments being taken from the date of the dispatch of the Court of Directors, which date is not invariably the 31st December or 1st January, the period comprised in the year of appointment is not a complete year. Of the 19 men appointed in 1790, 15 only arrived in India in that year; the remainder came in 1791. But whether they arrived or not would not very much signify, if we had their life to reckon for a complete year. The material circumstance is, that the appointments were made at different dates, mostly, indeed, in the first half of the year before May; but one gentleman (Mr. Leycester) was appointed in December, 1790, and yet reckons high on the list of the year. For this last reason, added to the difficulty created by the non-arrivals, it has been deemed

\* This number is one short of the true, because there were two Robert Grahams appointed in the same year, and they were supposed to be the same person.

(1), in the first year, being together 6; also the appointments of the year 1831 (29), which could not be included in the computation, unless the year 1832 were brought in. The number, therefore, of Civil Servants appointed between 1790 and 1831, who were in the condition to abide the chance of life for a first year, commencing from the 1st January after their appointment, was 905. Our table assumes 904, because there was one retirement in the year we are reviewing; and, as those who retire give the risk of their lives only for the broken period before their departure, the number of persons on the register on the 1st January requires correction on their account. It is assumed, that retiring servants give, on the average, the risk of their lives for half the year in which they retire; accordingly deduction is made, from the registered numbers on the 1st January, of half the number of the retirements between that date and the 31st December following. Where the number is uneven, as in this case being *one*, the deduction is made alternately to include or reject the unit. We thus begin with 904 lives, of which the proportion of deaths in the first year was 17, being in the ratio of 188 out of 10,000. For the computation of the ratio in the second year, we have the 905 men of the first year, minus the whole number of retirements (1), and deaths (17), in the course of that year, and minus also the appointments of 1830, which were 25, that is, 905—43 or 862. Of this number of registered servants on the 1st January of the second year, four retired in the course of the year: deducting two, therefore, for the diminished risk upon their lives, the number 862 stands corrected to 860, of which number 21 died in the year, being in the ratio of 244 out of 10,000. A separate value has thus been computed for each year of life in India, from the first to the thirtieth inclusive; after which the number of registered servants becomes too small to afford results at all trust-worthy. Before we proceed to the tables exhibiting the estimate of the value of life for each year, formed on this principle, it will be proper to exhibit separately the precise number of survivors in India, on the first of January of each year of their service; it being my purpose, as above explained, to compare these numbers, not with the original appointments as in the table of the GLEANINGS, but with the deaths of the year then commencing. I shall presently explain why no correct result could be extracted, from a comparison of the survivors with the number of original appointments, or even with that of arrivals in India. See Table, No. II.

Taking the table of survivors as the material for calculation, the ratio of deaths is exhibited for each year in the table which follows, No. III. The same ratio is reduced to a decimal proportion upon 10,000, for more ready deduction of the average of each five years, and for comparison with the tables of Europe. The number of deaths assum-

ed, and the moiety of retirements deducted in Table II, may be tested by comparison with Table I, in which all the appointments, deaths, and resignations are separately entered, according to the calendar year in which they occurred.

TABLE III.  
*Showing the Ratio of Annual Deaths.*

| Years of Residence. | Age. | Lives at risk on 1 Jan. | Deaths during the year. | Ratio of Deaths upon 10,000. | Average of 5 years. | Average of 5 years, according to Table in Gleanings. | Average of Dr. Young's mean for England. | Ratio of column 5 adjusted by averages of five years. |
|---------------------|------|-------------------------|-------------------------|------------------------------|---------------------|--|--|---|
| 1                   | 20   | 904                     | 17                      | 188                          | 203                 | 128  | 96½                                      | 188   |
| 2                   | 21   | 860                     | 21                      | 244                          |                     |  |  | 207   |
| 3                   | 22   | 792                     | 15                      | 189                          |                     |  |  | 203   |
| 4                   | 23   | 735                     | 18                      | 245                          |                     |  |  | 489   |
| 5                   | 24   | 669                     | 10                      | 150                          |                     |  |  | 191   |
| 6                   | 25   | 684                     | 8                       | 117                          | 209                 | 162  | 133                                      | 199   |
| 7                   | 26   | 593                     | 15                      | 253                          |                     |  |  | 211   |
| 8                   | 27   | 557                     | 13                      | 233                          |                     |  |  | 209   |
| 9                   | 28   | 532                     | 16                      | 301                          |                     |  |  | 210   |
| 10                  | 29   | 503                     | 7                       | 139                          |                     |  |  | 216   |
| 11                  | 30   | 479                     | 6                       | 125                          | 179                 | 165  | 155                                      | 207   |
| 12                  | 31   | 460                     | 13                      | 283                          |                     |  |  | 171   |
| 13                  | 32   | 431                     | 8                       | 186                          |                     |  |  | 179   |
| 14                  | 33   | 408                     | 5                       | 122                          |                     |  |  | 177   |
| 15                  | 34   | 386                     | 7                       | 181                          |                     |  |  | 175   |
| 16                  | 35   | 356                     | 4                       | 112                          | 214½                | 205  | 170                                      | 181½  |
| 17                  | 36   | 343                     | 6                       | 175                          |                     |  |  | 206   |
| 18                  | 37   | 315                     | 10                      | 317                          |                     |  |  | 214½  |
| 19                  | 38   | 287                     | 7                       | 244                          |                     |  |  | 268   |
| 20                  | 39   | 266                     | 6                       | 225                          |                     |  |  | 317½  |
| 21                  | 40   | 238                     | 9                       | 378                          | 370½                | 411  | 203                                      | 349½  |
| 22                  | 41   | 212                     | 9                       | 424                          |                     |  |  | 391   |
| 23                  | 42   | 189                     | 9                       | 476                          |                     |  |  | 370½  |
| 24                  | 43   | 165                     | 5                       | 303                          |                     |  |  | 372½  |
| 25                  | 44   | 147                     | 4                       | 272                          |                     |  |  | 421   |
| 26                  | 45   | 129                     | 5                       | 388                          | 403                 | 811  | 247                                      | 348   |
| 27                  | 46   | 105                     | 7                       | 666                          |                     |  |  | 394   |
| 28                  | 47   | 90                      | 1                       | 111                          |                     |  |  | 403   |
| 29                  | 48   | 75                      | 4                       | 533                          |                     |  |  | 407   |
| 30                  | 49   | 63                      | 2                       | 317                          |                     |  |  | 407   |
| 31                  | 50   | 51                      | 0                       | 0                            | 582                 | 326  |  |   |
| 32                  | 51   | 42                      | 0                       | 0                            |                     |  |  |   |
| 33                  | 52   | 36                      | 3                       | 833                          |                     |  |  |   |
| 34                  | 53   | 27                      | 2                       | 741                          |                     |  |  |   |
| 35                  | 54   | 22                      | 0                       | 0                            |                     |  |  |   |
| 36                  | 55   | 17                      | 1                       | 588                          |                     |  |  |   |
| 37                  | 56   | 11                      | 1                       | 909                          |                     |  |  |   |
| 38                  | 57   | 8                       | 0                       | 0                            |                     |  |  |   |
| 39                  | 58   | 6                       | 0                       | 0                            |                     |  |  |   |
| 40                  | 59   | 5                       | 0                       | 0                            |                     |  |  |   |
| 41                  | 60   | 3                       | 1                       | 3,333                        |                     |  |  |   |

TABLE IV.

*Showing the Annual Decrement of life, according to the adjusted annual value of Life in India, as compared with the latest Tables for England, and with the rate of Decrement in the Gleanings for September, 1881.*

| Dr. Young's general mean of decrement for England, calculated upon 100,000 Births, and commencing with survivors at 20 years of age. |            |         | Decrement in India upon the same number, calculated for each year at the adjusted annual ratio of Deaths of Table III. last column. |         | Decrement upon the number of survivors at the age of 20 out of 10,000 births, according to the Northampton Tables as given for India in the Gleanings. |         |
|--|------------|---------|---|---------|--|---------|
| Age.   | Survivors. | Deaths. | Survivors   | Deaths. | Survivors.   | Deaths. |
| 20   | 52221      | 452     | 52221   | 981     | 5132   | 63      |
| 21   | 51748      | 473     | 51240   | 1061    | 5069   | 64      |
| 22   | 51259      | 409     | 50179   | 1019    | 5005   | 65      |
| 23   | 50737      | 557     | 49160   | 929     | 4940   | 66      |
| 24   | 50180      | 610     | 48231   | 921     | 4874   | 67      |
| 25   | 49570      | 652     | 47310   | 941     | 4807   | 68      |
| 26   | 48918      | 655     | 46369   | 979     | 4739   | 69      |
| 27   | 48263      | 664     | 45391   | 949     | 4670   | 69      |
| 28   | 47599      | 682     | 44442   | 933     | 4601   | 70      |
| 29   | 46917      | 704     | 43509   | 940     | 4531   | 71      |
| 30   | 46213      | 709     | 42559   | 981     | 4460   | 72      |
| 31   | 45504      | 711     | 41578   | 711     | 4388   | 73      |
| 32   | 44793      | 710     | 40867   | 732     | 4315   | 75      |
| 33   | 44083      | 708     | 40135   | 710     | 4240   | 77      |
| 34   | 43375      | 710     | 39425   | 690     | 4163   | 79      |
| 35   | 42665      | 712     | 38735   | 703     | 4084   | 81      |
| 36   | 41953      | 718     | 38032   | 783     | 4003   | 83      |
| 37   | 41235      | 723     | 37249   | 799     | 3920   | 85      |
| 38   | 40512      | 728     | 36450   | 977     | 3835   | 87      |
| 39   | 39784      | 740     | 35473   | 1126    | 3748   | 89      |
| 40   | 39044      | 762     | 33147   | 1158    | 3659   | 96      |
| 41   | 38282      | 780     | 31989   | 1155    | 3563   | 110     |
| 42   | 37502      | 796     | 30834   | 1142    | 3453   | 130     |
| 43   | 36706      | 803     | 29692   | 1105    | 3323   | 150     |
| 44   | 35903      | 808     | 28587   | 1203    | 3173   | 175     |
| 45   | 35095      | 830     | 27384   | 953     | 2998   | 198     |
| 46   | 34265      | 850     | 26431   | 1041    | 2800   | 198     |
| 47   | 33415      | 867     | 25390   | 1023    | 2602   | 198     |
| 48   | 32548      | 880     | 24367   | 992     | 2404   | 198     |
| 49   | 31668      | 900     | 23375   | 951     | 2206   | 198     |
| 50   | 29705      |         | 22424   |         | 2080   |         |

The results of the first of these tables by no means correspond with those given in the GLEANINGS, and will not admit of very ready comparison. The ratio of deaths, however, to the number of survivors set down for each year in that article, has been calculated in order that the extent of discrepancy may be seen. But it strikes me, that there is a fallacy in the GLEANINGS' Table, which, besides that there are errors in the numbers assumed as above pointed out, must make it valueless for any

computation of the risk of life in India. The basis of calculation for each period there taken is the following. The number of appointments made between 1790 and 1819, (I take this year at random,) is stated at 603. By the end of 1828, the last year's servants will have been 10 years in India, or at least on the register; and computing the results of all these appointments for 10 years, it is found that there were 39 retirements and 77 deaths amongst them in that period. It is hence assumed, that in 10 years 77 deaths take place in 603, minus 39, or 564 cases of persons resident in India between the ages of 20 and 30, leaving 487 survivors. But how can this be a true ratio, when the risk of life upon the 39 cases of retirement, *while they remained in India*, is lost to the calculation. This number should not have been deducted from the 603 appointments as consisting of cases taken out of the life risk altogether; but if any correction were attempted, it should have been made by deducting only half the number, on the principle that the country had the risk of their life while they staid in it, which may be computed on the average at a half risk. The number of deaths would then perhaps have borne a pretty correct proportion to the appointments, but the number of surviving residents would have needed a like correction. The omission to note this makes but little difference, perhaps in the earlier years, wherein there are comparatively few retirements, but it has wonderful effect on the ratios of the later. Take for instance the 25th year, of which the data are as follows: appointments from 1790 to 1804, 341; resignations out of these in 25 years, 93; deaths, 105. Now, it makes a very material difference whether these 105 deaths are to be taken as 105 out of 341, minus 93, i. e. out of 248, giving 143 survivors, as in table the second, page 274, or 105 out of 341 minus  $\frac{93}{2}$  or 46 being 295, leaving 190 survivors. The number of survivors in India is however the actual number found in the registers that cannot be changed, and the calculations of the GLEANINGS' article are made on this number. The question therefore is presented in a different shape, and if this number be made the basis of any estimate or calculation, there must be corrections applied to settle out of how many these are the remnant from the effect of *mortality only*. For the fact, that many servants, after abiding the risk of life for 20 years, have at last withdrawn themselves while still living from both the survivors' list and from the original number, must leave the deaths upon the remaining appointments to bear a much higher ratio than they ought to do. Suppose, for instance, out of 100 arriving in a given year, 40 die in the course of 25 years, and 40 more having given the risks of their lives

for 20 years, retire living between the 20th and 25th, then, by the table at page 274 in the GLEANINGS, these 40 being deducted from the 100, the deaths would be stated at 40, out of 60, and the survivors only 20 of *that* number. This circumstance, viz. the fact that the retirements come mostly in the later years of service, will of itself explain the wide difference apparent in the value of life in the later years, compared with the earlier as exhibited in the article in question, and remarked upon there as if fully established. The table at page 274 shows a decrement of very nearly 1-12th of the number living, for each year, from the age of 45 to 50, which is out of all reason: one in 41 to 1 in 37 is the ratio of the Northampton tables quoted for the same age, and the difference of climate cannot surely triple and quadruple this mortality at that period of life\*.

Looking upon all computation from the *number of survivors* after a given period as impossible, in consequence of the large proportion of retirements in the advanced years of service, I am compelled to reject the tables of the GLEANINGS altogether, and offer instead those given above, which are based, as already explained, upon a comparison of the number of deaths in each year of service, with the number living, and in India on the first day of the year. This reduced to a decimal proportion will allow a comparison to be made of the value of life in each year, with the value assumed in the best approved tables of Europe. The retirements will not much affect a calculation made on this principle, and unless error can be detected in the numbers assumed for the deaths on one hand, or for the total of risks on the other, I am not aware of any ground on which the comparison can be impugned. Proceed we therefore to this part of the subject, and first for the age of appointment. In the article of the GLEANINGS this is taken at 20 years. Now, considering that 15 years was heretofore the age of earliest appointment, and 22 years the latest permitted by Act of Parliament; considering too that until 1806-7, there was no detention at the Hertford or Hayleybury College, but those appointed were at once shipped to their destination; so that many actually reached India before they were 16: this assumed age appears too high, 17 years for the age of arrival before the establish-

\* Per Table in the Gleanings.      Per Northampton ditto.

| Age.     | Deaths. |               |
|----------|---------|---------------|
| 45 ..... | 1 in 15 | ..... 1 in 41 |
| 46 ....  | 1 in 14 | ..... 1 in 40 |
| 47 ..... | 1 in 13 | ..... 1 in 39 |
| 48 ..... | 1 in 12 | ..... 1 in 38 |
| 49 ..... | 1 in 11 | ..... 1 in 37 |



ment of the College in England, and 19 for the average subsequently, or for the general average 18 years would seem to be a fairer estimate; but we will allow 19, for the convenience of assuming the same period of life for our results, as the article in the *GLEANINGS*; for as in the above tables the first year is reckoned from the 1st January following the appointment, we have then 20 years for the age of those whose risk of life is computed for that year. In Tables III. and IV. I have attempted a comparison of the value of life in India, from the age of 20 to 50, as afforded by the above tables for the Civil Service on one hand, and as given in the most approved tables for the same age in Europe on the other.

It will be seen, that for the value of life in Europe, I have taken the general mean prepared by Dr. Young, by compounding the Northampton and Carlisle tables with the London Bills of Mortality, and with the rates of the Equitable Life Insurance. This I believe to be the latest estimate of the kind that has been published. It will be found in the volume of the Philosophical Transactions for 1826, and Dr. Young's celebrity as a calculator entitles it to be received as of first rate authority.

In Table III. in which the annual deaths are given as they occurred, with the ratio calculated to a decimal proportion for each year, there will be found an average of the same decimal ratio for each five years of the period embraced in the calculation. In order to afford the means of ready comparison, I have also computed the ratio of deaths to the annual survivors, as given in the table in the *GLEANINGS*, and in Dr. Young's table of the decrement of life, and have reduced both to a decimal proportion to 10,000. It will be seen, that my result is for the first five years of residence in India, commencing at the age of 20, a risk for each year of 203 in 10,000. The tables of Europe make the risk at the same period of life only  $96\frac{1}{2}$  in 10,000, while the table in the *GLEANINGS*, professing to be based on the same materials with my own, but calculating from the number of survivors upon a total of appointments, from which retirements have been deducted, gives 128. There are errors in the number of deaths, which account for much of this latter difference; for if a due number of deaths had been taken for the first two years, there is no reason why in this part of the table there should be much variation. The result of the comparison with England is, that the chance of death between the ages of 20 and 25 is to Europeans residing in India under the most favorable circumstances, more than double what it is in England; and this may well be imagined to be the case under the risks from Fever and exposure to the climate, independently of other causes.

In the second five years our proportion is 209 out of 10,000 for each year's deaths, whereas in England it is only 133; but this difference is no longer double, it is only a little more than 3 to 2. The GLEANINGS' table gives 162.

The third lustrum of residence is the most healthy period, according to our table, and experience is in favor of the same conclusion. The constitution is now adapted to the climate, and the seeds of premature decay, though they may have been sown, have not had time to produce their effect. For this period of life India is nearly as safe a place of residence as England, and it is the only period during which there is any proximity at all in the ratios. From this time forward the yearly value of life progressively and regularly decreases as age advances, and it will be observed to do so much more rapidly in India than in England. The error of principle in the calculations of the GLEANINGS begins to be particularly observable in the ratios for the two periods following the fourth. From 205 in 10,000, the rate of the third period, the deaths according to that table advance to 411 for each year, after a residence of 20 years, and to 811 for the years between 25 and 30 of residence. Our result, though as compared with the general mean for England, worse for Indian residents of this standing, in the proportion of 5 to 3, is nevertheless much less unfavorable than the rate above quoted; indeed, for the last period our rate is less than half that of the GLEANINGS.

The results for the years after the 30th of residence, are founded on too low numbers to be built upon, and yet the average on the totals to the 41st year comes pretty nearly to the rate one might have expected. The further deterioration of value corresponds with that afforded by the mean tables of Dr. Young for the same period of life, and may be noted as a curious result, though the ratio cannot be looked upon as established.

In Table IV. I have thrown the results of Table III. into a form to shew the *decrement* of life according to my computation of its value for each separate year. This has been done merely to satisfy the curiosity of those who delight in seeing the same results in different shapes; and because the published tables being ordinarily in this form, it is convenient to present the means of ready comparison by giving one to correspond. For any purposes of calculation, the separate value ascertained for each year of Indian life, from the age of 20 to 50, seems the more useful result to depend upon.

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III.—On the Gypsum of the Himalaya. By Capt. P. T. Cautley,  
Ben. Art'y.

While there appears to be a general unwillingness on the part of geologists to admit the gypsum of the Alps as a recent formation, the leading authorities in that science are divided whether to consider it as *primitive*, or to class it among the indefinite *transition* formations.

M. Brochant has reviewed the gypsum formations of the Alps, and given his opinion on their relative antiquity : we have also accounts of other countries, betraying the same uncertainty with reference to the point at question : and perhaps we may not be far wrong in attributing many of the doubts in the classification of gypsum and other similar minerals, to the very interpolation of the order *Transition*, an arrangement convenient enough as offering a resting place for every variety not stamped with the decided mark of primary or secondary, but to the scientific inquirer a most deplorable bar to *precision*, a term not inapplicable altogether to the science, as we may hope to find it under a revised, well arranged, and *permanent* nomenclature.

The gypsum of the Paris basin, that accompanying the red marl of England, and that of other similar localities, have been acceded to as secondary formations by all geologists ; while those found in the higher mountain ranges of the globe have from their singular and generally ill-defined position, placed authors in doubts as to their classification. M. Brochant argues, that from the similarity of appearance in Gypsum rocks, he should be led to ascribe them all to the same era ; and from his own observation decides, that they all belong to the *transition* series, with this difference, which he deems important, that the ancient secondary gypsum of Bavaria, Saltzburg, &c. &c. reposes on strata essentially posterior to the transition class ; an objection, as De la Beche observes, nugatory from the frequent conjunction of the primary and secondary strata, exemplified by the oolite of the Jura resting on gneiss in the Rhine, &c. But although we find the superior classes of the secondary rocks in *conjunction* with the higher classes of the primary, the latter order is never found reposing on the newer formations ; indeed the only example given of an occurrence of this sort is by McCulloch, of gneiss on a secondary rock, which is noticed in the preface to Conybeare's work, and exemplified by a drawing, most satisfactorily explaining the deception.

\* The term *secondary*, as here used, includes what is generally called *tertiary*,  
—ED.

Saussure, Daubuisson, and others, have conceived some of the Alpine gypsum to be primary ; that of Cogné, mentioned by Brochant, as discovered and considered primitive by Daubuisson, obtaining the distinction from a superincumbent stratum of lime-stone "a little crystalline, blueish grey, and very schistose from a mixture of talc ;" the gypsum having no outcrop whatever, and consequently being imbedded in the above rock ; and, as M. Brochant says there is every reason to suppose that the schistose limestone of the roof contains quartzose veins, as also happens in transition limestone, he, rather gratuitously, concludes that the formation is contemporaneous.

The presence of these quartzose veins, which is the *type of transition*, and the absence of outcrop, rest on the mere ipse dixit of the villagers, and can hardly be received as proofs in a matter where direct geological accuracy is concerned. The deposit also of Val Canaria is a very doubtful proof of the existence of gypsum primarily. The fact of its underlying mica slate is contradicted by Brochant, who thinks the same of his transition variety. The proof of its being primitive is therefore still far from being ascertained, and I propose in a future part of this paper to suggest causes that might place in doubt, even the superincumbence of mica slate as a proof of its antiquity. The general description given by writers on the subject of Alpine gypsum, so closely applies itself to the mineral lately found in the line of mountains north of the *Dehra Dûn*, both in regard to its position and its attendant rocks, that a comparison becomes exceedingly interesting, as illustrative of the difference, if there be any, of the gypsum decidedly secondary, and that which is accompanied by rocks of evidently a more ancient formation.

The localities which have come under my immediate observation are two of those adverted to by Captain Herbert, in his communication to the Society. The first near *Sansardhâra*, immediately on the skirts of the mountains bounding the valley of *Dehra*, on the north : the second about four miles further north, near the village of *Salkot'h*, differing in position most essentially from the former, though resembling it in character ; to enter into a detail of each, with its respective peculiarities will be necessary in furtherance of the history of the rock in question.

#### *Gypsum opposite Sansardhâra.*

Immediately opposite the stalactitic caves, and beyond the rapid stream that runs towards the village of *Nagul*, a passage into the mountains is effected up the course of one of its tributaries, which branching off to the left, leads you at once to the gypsum, the prox-

imity of which becomes apparent from the masses and broken pieces in the bed of the stream. A considerable slip in the mountain, of a very recent date, displays the position of the rock, which would doubtless otherwise have remained concealed, as no vestige whatever can be found on the unbroken surface of the mountain. To give therefore an explicit account of its actual dimensions, or even to describe the locality, is perfectly impossible, further than what is exhibited to the eye: from the confusion attending on these fractures, and the precipitous and irregular structure of the mountain, covered with vegetation and an impervious wood. The gypsum is apparent here in two beds or strata, separated by a reddish argillaceous schist, and reposing upon a blueish limestone, in contact with which there are evident signs of passing one into the other. Independent of these beds or strata, unconnected and insulated masses of gypsum appear throughout the schist, the whole lying horizontal without any apparent dip or inclination. Beneath the bluish limestone, on which the lowest stratum rests, are varieties of a lime rock, of a darker color, reticulated with veins of calcareous spar, large rhomboidal crystals of the latter being found of considerable size, and in a much greater proportion than in the neighbouring mountains: indeed, the debris formed by the slipping of this face of mountain is altogether composed of these varieties of limestone, fragments of calcareous spar, and the pieces of broken gypsum and schist. The quality of this gypsum varies as much as its color; the former from a compact crystalline mass, to a loose, powdery, and arenaceous soil, hardly to be termed rock; the latter from a pure white, slightly translucent at the edges, to a dirty grey, particularly in its passage into the limestone. The colors however are exceedingly various: a brilliant yellow variety was discovered in great abundance. The height of this deposit from the bed of the stream is about 1000 or 1200 feet. The mountain series decidedly calcareous.

#### *Gypsum at Salkot'h.*

The former gypsum I have explained as alternating to all appearance with argillaceous schist, and forming a series with rocks, the antiquity of which may be a matter of remark hereafter. This gypsum is apparently superficial, and entering into the series more as an independent formation, than as a feature expressive of the general structure of the mountain. It shows itself opposite that village, about four miles north of *Sunsadhára*, jutting from the face of the mountain in a bold and irregular outline, to the height of about 200 feet from

the bed of a tributary that joins the Nagul stream, opposite the village of *Sulkoth*. The whole mass is composed of gypsum, without the intervention of any alternating rocks ; and a conclusion may naturally be drawn from the absence of the mineral in its vicinity, that this deposit is insulated, or simply an enormous nodule, resembling those of calcareous tufa so frequently met with, in detached and unconnected masses. The falling down of large masses of the upper part of the rock has caused such confusion and irregularity below, that it would be even doubtful whether the deposit actually extends to the bed of the stream, or whether its limits might not properly be curtailed to a depth of at least one-half, a circumstance moreover that precludes the possibility of discovering the rock on which it lies, or of satisfactorily describing the concomitant formations. The same difficulty generally occurs with these rocks; their decomposition is universally great, and the extreme variableness in texture so open to the attacks of weather, that externally, without the aid of slips and fractures, it is almost impossible to detect any regularity in stratification, or in fact any clue wherewith to form an idea of their general character. The tendency that this rock has to form itself into peaks and protruding points is well preserved here, and deserves mention from a peculiarity for which it is distinguished in the Alps; resting solely however upon the decomposing character of the rock, and from no material *form* of composition. The mountain itself is formed entirely of the blueish limestone formerly mentioned, into which the gypsum decidedly passes, modifying itself into a blueish variety, effervescent, and differing only in appearance from the limestone itself, by its want of compactness, and loose and friable quality: a black fragmentary and argillaceous lime rock is also in abundant dissemination throughout the lower part of the deposit, and singularly attached to those parts where the gypsum appears to be of a purer quality than at others; indeed it generally appears that by the presence of the rock in question, the mineral acquires a purity both in color and texture, unobtainable in those parts in contact with the blue limestone or at a distance from the black rock. It would be endless to enumerate the colors that appear throughout this formation; from the purest white crystalline, it passes through dirty grey pink, until it arrives at the blue limestone, when it obtains a tinge of that color. The texture is also as variable, and I may say, that throughout the whole deposit a very small proportion is of that variety generally known by the name of alabaster; and

even those parts so fragmentary, and so interspersed with the coarser varieties, that any attempt at converting it into ornamental uses would, I fear, be out of the question. The specimens that I have seen in cups and small vases fully authorize this conclusion: their appearance being more of a white earth, or chalky limestone, than of a gypsum, or to speak in plain terms, of an alabaster. The varieties of Himalayan gypsum as yet discovered are certainly deficient both in beauty and value as an article of use, though interesting for comparison with other formations.

Selenite, in small tabular crystals, is disseminated throughout this gypsum, though in hardly sufficient abundance to give any peculiar character to the formation.

A question of considerable interest arises from the appearance and position of the above-mentioned deposits, which, as mentioned in a former part of this paper, from their position under rocks of the primary and secondary classes, acquire an appearance of antiquity, not borne out by the general history of the mineral; namely, that the gypsum throughout the globe is simply an infiltration analogous to the tufa and calcareous deposits, and depending on causes chemically similar; the sulphuric acid being the active generator instead of the carbonic. If in the proximity of sulphur an excess of oxygen would produce sulphuric acid, a difficulty is removed, and the contact with lime-rock or carbonate of lime would, it may be supposed, produce its sulphate, or gypsum; and I cannot perceive the improbability of such a process having been or being still in force; or that nature's laboratory might not have been as active in the dissemination of gypsum, as it is in the present day, of the calcareous tufa.

The argument obtains considerable weight from a most material circumstance, which almost makes it a matter of certainty that the origin of all gypsums is contemporaneous; this is, the exact resemblance both in texture and crystallisation that they all bear, whether Alpine, or those varieties found with the secondary rocks: a similarity that does not exist in any of the lime-stones formed at different periods, nor in other rocks: the primary and secondary varieties shewing the most decided dissimilitude both in texture, quality, and position.

The term infiltration must be received, as implying the simple power of a mineral in solution to insinuate itself into cracks and fissures, or to fill hollows and cavities, without any reference to a gradual process, as it is possible that the mineral in question might in many instances (parti-

cularly in those deposits where an appearance of stratification or alteration with other rocks is apparent) have undergone a change, more sudden, and more general, than what we understand by the term "infiltration," as applies to the formation of calcareous tufa. A question may be put, as to the absence of any impressions of vegetable remains,—as to the want of the cylindrical and radiated texture, which so peculiarly marks the tufa in formation? It must be confessed, that on comparing the minerals, and supposing the process under which they are found to be *similar*; difficulties, though not irreconcilable to the above supposition, present themselves. In the first place, the action of sulphuric acid would tend in a much more rapid degree to the formation of gypsum, than does the presence of carbonic acid and lime to produce tufa. The same rapid action would create a texture of a totally different quality, and the ingredients themselves would destroy any vegetable remains that might be enveloped in the mass: had the same gradual and slow process that forms the tufa been also exerted in forming gypsum, similar texture would have been the consequence; and the deposit of the latter would shew at least marks of stalactites, &c.; but though infiltration is granted as a solution of the problem, the action of time and other causes may have removed those outward and visible marks that might have tended at once to a direct conclusion. Age, pressure, and other causes, are well known as the means of producing most extraordinary changes in the system, and also in the texture and quality of the rocks themselves. The above causes, in a greater or less degree, may have equally exerted their effects on gypsum.

The obvious transition of the blue limestone into the gypsum at the deposit at *Salkot'h*; and the extreme purity of the gypsum when in contact with the black fragmentary rock, which scarcely effervesces with acids, leads me to the idea that all these varieties of lime-rock in the proximity of the mineral are simply modifications, caused by the action of the sulphuric acid in a greater or less degree. The springs and rivers in the vicinity of all these formations abound in carbonic acid, as is evident from innumerable deposits of tufa, and stalactitic formations;—while the rocks themselves are of limestone:—near *Sansadhára*, sulphur and sulphuretted hydrogen impregnate the waters, and it is at least plausible to suppose from the occurrence of gypsum, that the presence of sulphuric acid is one, if not the main cause of the superabundance of carbonic acid diffused through all the springs, and leading to the tufaceous and stalactitic deposits of lime that not only appear



in such magnificence at the caves of *Sansardhára*, but actually give a coating to the bed of the streams, and are the cause, I conclude, of the enormous excess of local conglomerate that appears throughout the whole of the ranges, of which *Masúrí Tibá* and *Bhadraj* form such prominent features; the latter mountain terminating the range towards the Jumna, whilst the eastern or opposite extremity, under the name of *Skanda Déhi*, is washed by the Ganges. The yellow color of some varieties of the gypsum may depend on the contact with sulphur\*, the abundance of which mineral may be concluded from the sulphuretted waters above alluded to:—that it was so in former times, is sufficiently shewn by the existence of the gypsum itself. Whether it is not daily forming may be a matter of doubt, at least in the above localities: we find independent masses of tufa apart from the proximity of springs and water, the course of the latter having changed or dried up; at least the argument would stand thus on the discovery of a mass of calcareous tufa similarly situated to the gypsum deposit of *Salkot'h*, or that of other countries, not forgetting the primary deposit of *Dau-buisson* at *Cogne*!

If therefore where carbonate of lime, sulphur, and water are abundant, the chemical change above mentioned, is allowed, or is supposed from analogy to be a probable consequence, gypsum can no longer be entitled to a place in either primary transition or secondary classes; but must be considered as an adventitious formation common to all ages, and produced by causes analogous to the present rapid formation of calcareous tufa. Amongst our primary and transition rocks, none can be assimilated to the stalactitic carbonate of lime; amongst our secondary or latest class of general rocks, there is none like the gypsum, that is to say, we know of none actually forming at this day. Causes that led to the formations of such abundance of gypsum formerly, may from unassignable reasons, no longer exist; and those which produce the tufaceous carbonates, then at rest, may now be in full vigor.

The above reasoning is not affected by any account of a gypsum deposit that I have met with, and although the regular stratification or alternation of gypsum with clay slate, as above alluded to, may at first be a startling objection to the proposed theory, it will on examination be easily accounted for. The above discovered deposit of gypsum was assumed actually to consist of strata, but this is somewhat doubtful.

\* Is not the yellow color due to the presence of oxide of iron?—Ed.

To those who may differ with me on the subject, I must observe in conclusion, that gypsum has never been found in a country or district where the presence of the lime carbonate has been wanting; but mostly in a position surrounded by vast tracts of that mineral, rising in successive ranges in the vicinity of springs and running streams, whose courses are marked by their deposit of lime, in the presence of springs impregnated with sulphur and sulphuretted hydrogen. When the very ingredients are at active work at the present day in the manufactory of stactite, may we not with circumstantial evidence at least, convict them of pursuing a different course, and under different times and circumstances of forming *gypsum*!

P. S. I may mention another deposit of the mineral on the *Masúri* range, on the descent from the ridge or spur upon which Capt. Brooke has fixed his residence, to the valley of the *Aglar* river. There are also appearances of it on the ascent from *Rajpúr* via *Jaraipani* to *Masúri*, in the black fragmentary rock interspersed with minute threads of the gypsum, although, as far as my observation has been directed, the mineral at this point does not appear in mass: at the former deposit however, on the slope to the *Aglar* river, we find it in great abundance, though in quality by no means superior to the *Sulkoth* variety; the situation is partly to the right and left of the foot-path on the ascent, in large nodular masses, or independent rocks, whose outer surface exhibits the usual sharp angular and pointed features, and partly in irregular lumps imbedded in the debris of a huge slip of the mountain, which must have fallen within the last few years, as it bears every appearance of freshness. Unless we are to suppose that the mountain from which this slip has taken place was in itself formed of debris, and the rounded boulders of water-worn rock, which I may safely assume not to be the case, the appearance of these detached masses of gypsum is very unusual; they neither look like pieces broken off from a large mass in the fall of the mountain, nor have they the least resemblance to boulders; but from their uneven honey-combed surfaces, I could almost bring myself to imagine, that they had been formed by infiltration into holes and fissures in the rock or soil; the outer surface decidedly having the appearance of being formed in a mould which the irregular internal surface of a natural cavity would exhibit. These pieces vary in size, but do not exceed in dimensions a cubic foot or thereabouts.

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## IV.—Climate of Chirra Punji.

• (Extract from a letter to the Surveyor General of India, from Dr. W. Rhodes.)

The remark in the *Hurkaru*, "that the rains had set in with great violence at Chirra," is incorrect. By a reference to the accompanying Table it will be observed that, for the last 20 days of the month, the weather has been remarkably fine and almost free from rain.

By a self-registering thermometer set at the beginning of the month, I find that the temperature during the day has been as high as 76, and at night as low as 56. The climate now is very delightful, and surpasses the finest summer months in England.

*Chirra Punji*, 3rd June, 1832.

W. R.

*Meteorological Register kept at Chirra Punji, for May, 1832.*

| OBSERVED AT 10 A. M. |            |                   |             |       |           |                       | OBSERVED AT 4 P. M. |                   |             |       |           |                       |  |
|----------------------|------------|-------------------|-------------|-------|-----------|-----------------------|---------------------|-------------------|-------------|-------|-----------|-----------------------|--|
| Date.                | Barometer. | Thermome-<br>ter. | M. B. Ther. | Wind. | Strength. | Aspect of<br>the sky. | Barometer.          | Thermome-<br>ter. | M. B. Ther. | Wind. | Strength. | Aspect of<br>the sky. |  |
| 1                    | 25,780     | 64                | 63½         | W.    | Var.      | Rain.                 | 25,740              | 67                | 67          | S.W   | Var.      | Cy. Rain.             |  |
| 2                    | 766        | 63                | 63          | S.W.  | do.       | do.                   | 760                 | 63                | 62          | do.   | do.       | do.                   |  |
| 3                    | 850        | 64                | 64          | W.    | Stg.      | do.                   | 764                 | 63                | 63          | do.   | do.       | do.                   |  |
| 4                    | 800        | 62                | 61½         | S.    | Var.      | do.                   | 788                 | 63                | 63          | do.   | do.       | do.                   |  |
| 5                    | 790        | 62                | 61          | W.    | do.       | do.                   | 696                 | 61                | 59          | E.    | Lt.       | Cloudy.               |  |
| 6                    | 786        | 63                | 62          | W.    | do.       | do.                   | 710                 | 63                | 62          | W.    | Var.      | Cy. Rain.             |  |
| 7                    | 781        | 63                | 62          | S.W.  | do.       | Cloudy.               | 690                 | 62                | 62          | do.   | Lt.       | do.                   |  |
| 8                    | 730        | 59                | 50          | do.   | do.       | Rain.                 | 700                 | 62                | 61          | S.W   | Var.      | Cloudy.               |  |
| 9                    | 736        | 61                | 60          | do.   | Stg.      | do.                   | 795                 | 63                | 62          | W.    | Lt.       | Cy. Rain.             |  |
| 10                   | 850        | 65                | 64          | W.    | Var.      | Cum.                  | 780                 | 70                | 65          | do.   | Var.      | Clear.                |  |
| 11                   | 860        | 67                | 65          | do.   | do.       | Cloudy.               | 720                 | 69                | 65½         | S.W   | do.       | Cloudy.               |  |
| 12                   | 836        | 69                | 66          | do.   | do.       | Clear.                | 700                 | 68                | 65          | do.   | do.       | do.                   |  |
| 13                   | 700        | 64                | 64          | do.   | do.       | Cloudy.               | 700                 | 68                | 66          | do.   | do.       | Clear.                |  |
| 14                   | 750        | 62                | 61½         | S.W.  | do.       | do.                   | —                   | 67                | 65          | do.   | do.       | Cloudy.               |  |
| 15                   | 800        | 65                | 62          | W.    | do.       | Clear.                | 750                 | 69                | 65          | W.    | do.       | do.                   |  |
| 16                   | 818        | 67                | 64          | Cm.   | do.       | do.                   | 750                 | 61                | 63          | do.   | do.       | Clear.                |  |
| 17                   | 820        | 67                | 63          | do.   | do.       | do.                   | 760                 | 69                | 65          | do.   | Lt.       | do.                   |  |
| 18                   | 830        | 70                | 65          | W.    | Var.      | do.                   | 770                 | 71½               | 70          | do.   | do.       | do.                   |  |
| 19                   | 854        | 64½               | 64          | do.   | do.       | do.                   | 800                 | 67                | 66          | do.   | Var.      | Cloudy.               |  |
| 20                   | 800        | 66                | 61          | do.   | do.       | do.                   | 784                 | 68                | 64          | S.W   | do.       | Clear.                |  |
| 21                   | 820        | 67                | 63          | Cm.   | do.       | do.                   | 750                 | 70                | 66          | W.    | Lt.       | do.                   |  |
| 22                   | 804        | 67                | 62          | do.   | do.       | do.                   | 760                 | 69                | 63          | do.   | do.       | do.                   |  |
| 27                   | 732        | 71                | 69          | do.   | do.       | do.                   | 700                 | 73                | 64          | S.W   | do.       | do.                   |  |
| 28                   | 750        | 72                | 69          | do.   | do.       | Cloudy.               | 684                 | 73                | 69          | Cm.   | do.       | do.                   |  |
| 29                   | 760        | 70½               | 68          | do.   | do.       | Clear.                | 680                 | 71½               | 68          | S.W   | Lt.       | Cloudy.               |  |
| 30                   | 766        | 71                | 66          | S.W.  | Lt.       | do.                   | 698                 | 71                | 65          | do.   | do.       | Clear.                |  |
| 31                   | 750        | 71½               | 69          | Cm.   | do.       | Cloudy.               | 700                 | 72                | 68          | do.   | do.       | Cloudy.               |  |
| Mns                  | 25,790     | 66,2              | 63,5        |       |           |                       | 25,736              | 672               | 64,5        |       |           |                       |  |

V.—*Proceedings of the Asiatic Society.**Wednesday, the 4th July, 1832.*

The Hon'ble Sir C. E. Grey, President, in the chair.

1. Mr. J. Pearson was elected a Member of the Society.

2. The Acting Secretary reported, that the amount of the late Dr. Bruce's legacy had been received and invested in Government Securities.

3. Upon the motion of Mr. F. C. Strong, seconded by Mr. D. Ross, the following resolution was passed unanimously :

“ A Report upon the progress of the boring experiment having been submitted at the last meeting of the Physical Class, 13th June, from which it appears, that a second perforation has been commenced upon and carried down to the depth of 160 feet successfully, having been already tubed to the depth of 120 feet : and further, the Government having expressed great interest in the result of the experiment, and having through Colonel Casement, Military Secretary, placed at the disposal of the Physical Class the services of three European soldiers of the Sapper and Miner Corps, lately arrived from England, who have been regularly instructed in the art of boring for water,—

*Resolved*, that a sum of Rs. 500, in addition to the 2000 already expended, be placed at the disposal of the Committee, for the further prosecution of the boring experiment.”

4. *For the Museum*.—Mr. F. P. Strong presented a flying fish.

Mr. J. F. Cathcart presented a specimen of a Cape fish, called there “ Sea-horse fish ;” also a pair of Cape pheasants.

Captain Sanders, Engineers, presented an ancient coin recently procured at Kanouj, by Mr. E. V. Irwin, C. S.

5. *For the Library*.—The following rare and valuable works were presented by the Hon'ble Sir C. E. Grey, President.

*Lexicon Græco-Latinum* Constantini, 1592.

*Platonis Opera Omnia*, 3 vols. folio, 1578.

*Aristotelis Opera Omnia*, 11 vols. 4to. in 6, 1587.

*Ciceronis Opera Omnia*, 10 vols. 4to. 1783.

The works of Dugald Stewart, 5 vols. 4to. London.

*Histoire de la Philosophie Moderne*, par Jean Gottlieb Buhle, 6 vols. 8vo.

The following works were also laid on the table :

Lament on the capture and destruction of Edessa, an Armenian Poem, written in the middle of the twelfth century, by Nierses Shinorbali, published in Calcutta, in 1832 ; presented by the Editor Mr. John Avdall.

Dictionary of the Tamul and French Languages, presented by Lieut. A. Blin, Mem. As. Soc. Paris, who announces his intention of publishing a French translation of Shakespear's Hindustani Grammar, printed “ par le procédé autographique.”

Meteorological Register for April—from the Surveyor General.

*From the Translation Committee of the Royal Asiatic Society.*

- Subscription copies of  
 No. 1. Translations from the Chinese and Armenian, by C. F. Neumann,  
 2. Life of Sheikh Mohammed Ali Hazin, .....  
 3. Miscellaneous translations from Oriental languages, vol. 1st, .....  
 4. The Algebra of Mohammed Ben Musa, .....  
 5. Life of Hafiz-ool-Moolk, Hafiz Rehmut Khan, .....  
 6. Travels of Macarius, .....  
 7. History of the Maritime Wars of the Turks, .....  
 Annual List of Donations and Bequests to the Trustees of the British Museum, 1830 ; *from the Trustees*, .....  
 Journal Asiatique, Nos. 44, 46, and 47. *From the Asiat. Soc. Paris*,  
 Considerations sur les Alphabets des Philippines. By Monsr. Jacquet, Paris,—*the author*, .....  
 The Christian's Magazine, No. 1 to 10, Pampt.—*unknown*, .....  
 List of the Geographical Society of London, January 1, 1832. Pamphlet,—*the Society*, .....  
 Proceedings of Do. Do. Nos. 22 and 23,—*the Society*, .....  
 Observations sur quelques points de la Doctrine Samaneenne, et en particulier sur les Noms de la Triade Supreme, par Monsr. M. Abel Remusat,—*the author*,

*From the Secretary to the Societé de Caen.*

- Essai sur les Combustions humaines, Rapport fait par M. P. A. Lair, à la Societé Linnéenne de Normandie, &c. .... 7  
 1 Rapport fait à la Societé sur l'utilité de la culture des Pommes de Terre dans le Calvados, ..... 2  
 1 Rapport fait à la Societé Royale D'Agriculture et de Commerce de Caen, sur les Troupeaux, &c. .... 8  
 1 Exposé Historique, &c. Monsr. Lair, 2  
 1 De la Pêche, du Parcage et du Commerce des Huitres en France, .... 2  
 1 Catalogue de la Bibliothèque de la Societé Royale D'Agriculture et de Commerce de Caen, ..... 2  
 Notices Historiques, ..... 2  
 1 Annuaire du Calvados, 1829, 30, 31, 3  
 3 Memoires de la Societé Linnéenne du Calvados, 1824, and 25, ..... 3  
 1 Compte rendu et Rapports des Travaux de la Societé Philharmonique du Calvados de 1827 et 28, 3  
 10 Discours sur la seconde exposition des Produits des Arts du Département du Calvados, ..... 6  
 1 Sur le Pommier, et sur une Nouvelle variété de Pomme, découverte in 1820, dans le Département du Calvados, ..... 9  
 2 Rapport sur les Voyages de M. d'Urville, &c. by Monsr. Lair, .. 2  
 A. M. Dumont-D'Urville sur le Retour de l'Astrolabe, ..... 3  
 Fête Pastorale de Blainville, .... 2

*Papers read.*

1. Answer to Dr. Milman's questions respecting the Indian Jews, by Daood, a respectable Jew residing in Calcutta. Communicated by Dr. J. Tytler.

These answers refer only to the recent establishment of Jews in Calcutta itself, not to those who have become naturalized on the Malabar Coast.

2. A descriptive Catalogue of the ancient Roman Coins in the Society's Cabinet. By Mr. J. Prinsep.

3. Translation of a fragment in the Tibetan language, by Mr. Csoma de Körös, with remarks by Mr. H. Wilson, Sec.

4. An Analysis of the remainder of the *Kahgyur*, by Mr. Wilson, was also laid on the table.

On the conclusion of the business of the evening the President rose, and addressed the meeting (which was unusually numerous), in the following words :—

“Gentlemen,—The pleasure of meeting a more numerous body of the Society than is usual, makes it impossible that I should find fault with my friend Mr. James Prinsep, for having added to the notices of the meeting an intimation that I should take my leave of you this evening. I regret only that it may have caused an expectation that I should offer a more complete tribute of gratitude than I am capable of expressing, or that I should have prepared for the Society one of those comprehensive views of the fields of literature, science, and art, which have been usual on similar occasions, and which generally are well adapted to them, but which I do not think would be suited to that of my own departure. Having never entered the vineyard as your fellow-labourer; I will not cull the fruits produced by the labour of others, that I may claim a merit for merely laying them before you, and arranging them. I feel, that there is little which it would become me to say on this occasion, but to excuse myself for what I have omitted to do. But it has always been known to you, that I neither have nor ever pretended to have any acquirements in Oriental Literature: and I should have almost thought it incumbent on me to decline even the gratification of being elected your President, if I had not regarded it as an honorary appointment, and known at the same time that as long as Mr. Wilson continued to be your principal Secretary, the Society could not suffer from any deficiencies of mine.—Gentlemen, he has really been your President: and I rejoice, that his absence from Calcutta affords me the opportunity of saying what I could not so well have said of him in his presence. Whether you consider his unrivalled attainments in Sanscrit Literature, or the many valuable works with which he has enriched your Transactions, or which he has otherwise given to the world, or his indefatigable and most meritorious devotion of his time and talents to the establishment of an extensive system of education for the native youth, or the many amiable qualities which distinguish him in private life, you must all feel that if you should lose *him*, of which there is at present some likelihood, you will indeed sustain an irreparable loss:—yet a loss not to be deplored by his friends, and least of all by me; for it might afford me the hope of meeting him soon amid other scenes, where the happiest portion of my youth was passed, and which, now that I am turning homewards, rise upon my waking memory with the vividness and imaginary beauty of a dream. This would indeed be to me a source of infinite pleasure, if it was not qualified, and if my mind was not divided, if I may use the expression, by the reflection that the event which would take Mr. Wilson to Oxford would leave in India another distinguished member of your Society, my excellent friend Dr. Mill, whose presence alone prevents me from expressing of himself praise as

fervent and sincere as that which with a willing ear he has heard of his rival in a generous contest. Gentlemen, though I have disclaimed, as I was bound to do, all acquirement or ability in the department of Oriental Literature, I will not pretend to entertain so humble an opinion of the results of a life which has at least been a studious and thoughtful one, as that there is no province of study in which I might have hoped to gather offerings which I should not have been ashamed to present to you. But here in vindication of my own consistency, and to shew at least that I dealt fairly by you in accepting the office of your President, I beg leave to recall what none of you are likely to recollect, that seven years ago, upon another public occasion, in taking leave of a Society at Madras, of which also I was President, I bade adieu at the same time to all literary employment, so long as I should fill the station to which I was called in Bengal. I foresaw that it would impose upon me a predominant duty, and one of which the most peculiar features are not perhaps the most obvious, and to which I knew my own mind too well to think I could give a divided attention. How I have performed that duty, this is not the place, neither is it for me, to say: but I will say, that to perform it aright, in its most important and essential particulars, has been the earnest and engrossing purpose of my soul. I do not look for a fair estimate in the present day. I have never weighed appearances against realities in the scale of popular applause. But time will declare it; and I am willing to abide the judgment of time. All that I desire at present is to offer the duties of my station to your consideration, as some apology for what might otherwise appear a neglect of what you had a right to have expected of me. From that station and those duties I have now retired, and I have to regret, that the leisure which I thus obtain can no longer be employed either in your service or your company. But in that studious retirement, which, I devoutly hope, awaits the latter portion of my life, I shall to the end of that life be proud that I have borne the name of your President, and I shall recollect with gratitude both the favor which conferred on me that honor, and the indulgence which has been attendant on my tenure of it."

The President sat down amidst a general demonstration of feeling on the part of the members, to which Sir Edward Ryan gave expression in the following reply:

"SIR,—I am requested by the members who are present, to express to you their feelings on this, I may truly say, sorrowful occasion. I wish they had selected some one more competent to be the organ of their thoughts and wishes, but at the risk, nay with the certainty of being unable adequately to express the feelings which your eloquent address has excited in their minds, I cannot decline the honor, for so indeed I consider it, which they have conferred upon me.

"For more than five years, Sir, you have filled that chair, and during the whole of that period, I repeat with confidence, you have evinced the deepest interest in the welfare of our Society—you have never willingly absented

yourself from our meetings—and you have taken an active and diligent part in the duties which devolve on your station amongst us. During this period, we have been indebted to your munificence, for a splendid addition to our Museum, of an extensive cabinet of minerals and geological specimens; and this night you have made a valuable addition to our Library, by the Books which are now before us. You have never lost sight of us in your occasional visits to different parts of India, and from the Himalaya and Penang you have added to the valuable collection, which we had received from you, specimens collected with your own hands. By your kindness, courtesy, and hospitality to those strangers whom science or literature may have guided to the shores of India you have shewn the respect we bear to their attainments.

“ Sir, half a century has nearly elapsed since this Society was founded by one who was then a Judge of the Court in which you so recently presided. I mean of course that great and good man Sir William Jones, to whose memory we cannot revert without the deepest sentiments of veneration and esteem. Many distinguished persons have since filled that chair, a proud distinction to any man: but I speak with sincerity my own feelings, and those I believe of the gentlemen around me, when I say, that, great as were the acquirements of many of your predecessors in their various paths of knowledge, the lustre which they have thrown over that chair has been brightened and enhanced by you.

“ I must no longer trespass on your time, but permit me to hope, that on your return to your native country, it may be some satisfaction for you to know, that you bear with you the respect, the esteem, and the regard of this body, over whom you have so long presided.”

The Acting Secretary was directed to take the usual steps for bringing before the Society, as soon as possible, the subject of the election of a President to fill the vacant chair.

## 2.—NATURAL HISTORY SOCIETY OF THE MAURITIUS.

*Tuesday, 20th December.*

M. J. V. Sganzi forwarded 17 stuffed birds from Ste. Maria Madagascar.

Letters from the following parties, acknowledged the receipt of honorary diplomas: the Rev. J. Adamson, D. D. Cape; Sir W. E. Parry, R. N. F. R. S. New Holland; Sir John Jamison, K. C. V. Sydney; Andrew Smith, Esq. M. D. M. N. S. Algoa Bay; Le fébure Marcy, Mahé, Seychelles Islands.

Other letters were submitted.

The following works were added to the Library—Annual Report of the Agr. and Hort. Soc. of Sydney; Journal des îles de France et de Bourbon, 1786-91.

M. Lislet Geoffroy presented a specimen of Bark obtained from a native chief in Madagascar, in 1815.

M. C. Telfair, Pres. offered in the name of Capt. Trotter, of the Corvette *Carlew*, a black *Ibis* of Agaléga; also some sea Cocos from the Praslin Isle, which he was desirous to introduce in the colony. Also, for the Library, a description of the Isle of St. Paul, with two views by Mr. Pollock.



The President announced that Mr. Hampton had commissioned from Madagascar two pair of crows, to attempt their multiplication on the Island.

Mr. W. Byer presented a list of objects collected and lodged in the Museum by 15 of his pupils since the 1st August.

Mr. Lienard, sen. read a note on a new species of *zanclus*, differing from that delineated in Cuvier, having one filament less in the dorsal fin, and one thorny ray in the pectoral fin.

Mr. J. Desjardins read the description of two new species of *chétodons*, a fish vulgarly called *pavillons* in the Island, as is the *zanclus* mentioned above. He gives them the names of *chétodon queue d'or*, [*chétodon chagsuries*,—J. DESJ.] and le *C. Joyeux* [*chét. festivus*, J. DESJ.]

The following gentlemen were proposed as honorary members—MM. Ivoneff Dupont, (resident,) F. Eydoux, J. Baume, J. O. Westwood, W. Twining, J. Verreaux, Richard, Dir. Bot. Gard. Bourbon, and J. Goudot, nat. Madagascar.

## VI.—SCIENTIFIC INTELLIGENCE.

### I.—Boring for water in France.

In Mr. Hericart de Thury's recent work on Artesian springs, the following curious fact is noticed relative to the distance to which subterranean currents percolate. A perforation made at Tours, brought up from a depth of 363 feet a quantity of fine sand, and the remains of vegetables and shells. Branches of the thorn were recognized, some inches in length, blackened by their long exposure to the water; also the stalks and roots, still white, of many marsh plants, and the seeds of many plants in a state of preservation, particularly of a species or variety of *Gallium*; fresh water shells were also discovered. It was supposed that the water of this well could not have taken more than four months to traverse its subterraneous course, because the seeds from their fresh state must have fallen on the preceding autumn; and that the supply came from some valley in Auvergne, or Vivarais, which is not so easily proved; but the fact is not the less curious.

In many of the departments of France, funds have been publicly subscribed for the purchase of a set of boring rods: in some, associations have been formed to use them, and great attention is paid to the enumeration of the strata pierced through by the instrument. At a shaft sunk at the Saint Owen gate, near St. Denis, in January 1829, no less than six springs of water were cut through, one stationary, and the five others ascending to different heights.—*Journ. des Savans*, 1831.

### 2.—Meteorological Averages at Canton and Macao.

Thermometer at Canton, Lat. 23° 12'. N.

|            | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual Mean. |
|------------|------|------|------|------|------|-------|-------|------|-------|------|------|------|--------------|
| Noon, ---  | 64   | 57   | 72   | 77   | 78   | 85    | 85    | 86   | 83    | 77   | 67   | 62   | 74.5         |
| Night, --- | 50   | 49   | 60   | 68   | 72   | 70    | 81    | 78   | 76    | 69   | 57   | 52   | 65.1         |
| Highest,   | 74   | 78   | 82   | 86   | 88   | 90    | 94    | 80   | 88    | 85   | 80   | 70   | 82.9         |
| Lowest,--  | 29   | 38   | 40   | 55   | 64   | 74    | 79    | 75   | 70    | 57   | 40   | 45   | 55.5         |

Mean temperature of Canton, 69.5

*Thermometer at Macao, Lat. 22° 16'.*

|          | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Mean. |
|----------|------|------|------|------|------|-------|-------|------|-------|------|------|------|-------|
|          | o    | o    | o    | o    | o    | o     | o     | o    | o     | o    | o    | o    | o     |
| Morning, | 62   | 59   | 66   | 73   | 77   | 82    | 84    | 82   | 81    | 75   | 65   | 62   | 72.3  |
| Aftern., | 65   | 59   | 69   | 75   | 78   | 84    | 88    | 85   | 84    | 78   | 68   | 65   | 74.8  |
| Highest, | 72   | 71   | 77   | 83   | 85   | 89    | 92    | 90   | 88    | 86   | 80   | 70   | 81.9  |
| Lowest,  | 53   | 49   | 55   | 66   | 71   | 74    | 81    | 79   | 76    | 61   | 57   | 57   | 64.9  |

Mean temperature of Macao, 73.5

*Fall of Rain at Macao, from 1812 to 1831, in inches.*

|      |      |                                    |      |      |       |       |      |      |       |      |      |      |       |
|------|------|------------------------------------|------|------|-------|-------|------|------|-------|------|------|------|-------|
| 1812 | 1.0  | 2.6                                | 5.4  | 6.1  | 19.8  | 16.0  | 12.2 | 14.1 | 17.6  | 6.0  | 4.3  | 2.2  | 107.3 |
| 1813 | 0.8  | 1.6                                | 1.0  | 4.2  | 14.8  | 13.0  | 5.8  | 5.7  | 5.1   |      | 2.2  | 0.5  | 54.5  |
| 1814 |      | 3.1                                | 2.8  | 5.4  | 18.6  | 29.0  | 11.9 | 7.2  | 4.4   | 4.5  | 8.8  |      | 95.7  |
| 1815 |      | From 1st January to 31st December, |      |      |       |       |      |      |       |      |      |      | 64.5  |
| 1816 |      | Ditto ditto,                       |      |      |       |       |      |      |       |      |      |      | 48.8  |
| 1819 | 2.5  | 3.8                                | 2.7  | 2.0  | 8.0   | 4.2   | 4.3  | 18.5 | 6.0   | 4.6  | 1.8  | 1.1  | 59.0  |
| 1820 | 1.5  | 0.3                                | 1.7  | 3.5  | 5.0   | 5.0   | 7.5  | 5.8  | 20.8  | 13.0 | 1.0  | 0.8  | 65.9  |
| 1821 | 1.0  | 3.6                                | 2.4  | 5.0  | 9.2   | 10.2  | 8.0  | 11.5 | 2.7   | 10.5 | 2.5  | 2.0  | 68.6  |
| 1822 | 0.5  | 0.3                                | 1.2  | 3.8  | 17.8  | 9.1   | 3.2  | 7.0  | 12.6  | 3.0  | 4.8  | 0.3  | 63.6  |
| 1823 |      | 0.1                                | 0.6  | 5.6  | 1.0   | 12.8  | 11.6 | 7.0  | 6.0   | 11.0 |      |      | 55.7  |
| 1824 |      |                                    | 0.8  | 3.0  | 6.2   | 17.9  | 4.7  | 4.3  | 16.7  | 6.4  | 7.0  | 1.6  | 68.6  |
| 1825 |      | 0.3                                | 4.0  | 3.5  | 8.5   | 13.4  | 7.0  | 13.6 | 8.2   | 3.8  | 1.0  | 1.0  | 73.3  |
| 1826 | 1.1  | 2.4                                | 2.8  | 18.6 | 5.8   | 4.4   | 11.8 | 11.5 | 15.2  | 3.5  | 2.7  |      | 79.8  |
| 1827 |      |                                    | 2.   |      | 9.9   | 8.7   | 9.2  | 16.  | 3.5   | .6   | 1.5  | 1.   | 51.8  |
| 1828 | .1   | 1.4                                | 3.6  | 11.1 | 22.8  | 17.4  | 10.9 | 10.0 | 16.2  | 5.9  | 0.2  | 4.6  | 104.6 |
| 1829 | 2.4  | 5.1                                | 1.4  | 10.1 | 12.1  | 4.2   | 4.1  | 9.2  | 8.8   | 1.0  |      | 0.8  | 59.3  |
| 1830 |      | 0.5                                | 1.0  | 0.4  | 4.4   | 4.6   | 7.1  | 10.3 | 19.4  | 5.3  | 1.0  |      | 52.9  |
| 1831 |      | 1.2                                | 0.9  | 6.6  | 25.6  | 7.7   | 4.5  | 7.0  | 11.7  | 9.2  | 0.8  |      | 75.3  |
| Mean | 0.68 | 1.67                               | 2.15 | 5.56 | 11.85 | 11.10 | 7.75 | 9.90 | 10.92 | 5.50 | 2.47 | 0.99 |       |

Mean annual rain, inches, 70.0

Rainy

days, 3½ 7 6 10 15½ 9 10 12½ 10 5 3 3½

The averages at Canton are taken from the Meteorological Diary of the Canton Register for 1831. Those at Macao are from a private diary by Mr. Blettermen, during the same year.—*Companion to the Anglo-Chinese Calendar of 1832.*

*3.—Polyzonal Lens.*

We are grieved to learn by a letter from Sir David Brewster to Mr. George Swinton, that there are at present little hopes of the accomplishment of the grand object, towards which the liberality of the lovers of science in India contributed so meritoriously a few years since. The failure of Messrs. Gilbert and Co. Opticians, who had already, it seems, executed one Lens on the Polyzonal principle for the Light-house Board, under the Dr.'s directions, had delayed further proceedings: and although the Firm was again established, the loss of all their tools and apparatus rendered it impossible for them to undertake the job at the price before settled, namely £80. Dollond and Co. would not attempt it under £400. Having experienced in these disastrous times the greatest difficulty in getting subscriptions from scientific men, Sir David had made a formal application to Lord Althorpe for some public aid, but this

also was refused from the state of the revenue. Sir David fears therefore that he shall be obliged to re-transmit the sum subscribed towards the Lens in India. This would indeed be a mortification, and we cannot help thinking, that if the grand Polyzoal Lens can really be completed at an expense of £120, the patrons of science in India would rather make up the whole sum required than abandon, on such an unworthy consideration, an experiment of national and universal interest.

#### 4.—Litharge of Ava.

In the examination of Ava minerals, printed in No. I. of this Journal, I expressed some doubt as to whether a specimen of crystallized litharge there described was a natural ore or an artificial product: the following passage in a letter from Major H. Burney sets the matter at rest.

P.

“Mr. Lane, upon further inquiry, ascertained that the litharge was not a natural but an artificial production. It was brought however from the *Shan* territory, and there is always much difficulty in obtaining correct information regarding the productions or proceedings of the *Shan* race.”—*Rangoon, 4th June, 1832.*

#### 5.—Timber Trade in Cachar.

Timbers sold in Cachar are divided into three kinds, called Gúndah, Dúm, and Kari. Gúndahs consists of Jarul only, and are used chiefly in Syllhet for boat building. They are sold at two rates, according to their size. Those timbers which are less than ten *haths* in length and six *múts* in circumference are called Pyah, and are worth about 27½ Rupees each on an average; but those above that size are sold by the *khálí*, which is a measure derived from a rude and inaccurate mode of estimating the cubic contents of the timbers, in which they are assumed to be regular parallelopipedons, thus: 10 *haths* X 6 *múts* X 6 *múts*, 360 parts, of which 250 make a *khálí*; the value at present of which is about 3 Rs. 6 annas. Six *múts* make a *hath*, and the *hath* is equal to 20 inches.

The following table includes various kinds of timbers used chiefly for posts, beams, and small boats. The prices of these are in proportion to their size, but may be stated just now as here given:—

|           |   |   |
|-----------|---|---|
| Nagísar,  | } | 25 <i>haths</i> by 3½ <i>haths</i> in cir. from 10 to 12 Rupees each. |
| Cham      |   |   |
| Awal,     |   |   |
| Teylo,    | } | 25 <i>haths</i> by 3½ <i>haths</i> in cir. from 9 to 11 Rupees.       |
| Súúf,     |   |   |
| Morye,    |   |   |
| Gandri,   |   |   |
| Gamér,    |   |   |
| Sílratta, | } | 25 <i>haths</i> by 3½ <i>haths</i> in cir. from 8 to 10 Rupees each.  |
| Sepai,    |   |   |
| Gandí,    |   |   |
| Jam,      |   |   |
| Chika,    |   |   |

Kari, consists of smaller trees running from 9 to 12 *haths* in length, which are sold in lots at from 1 to 1½ *cawns* per *hath* measured on the girth. The following are included in this class:

Ratta, Pumar, Karil, Kurta, Jokí, Singra, Chatní, Singtajah, Singdrinc, Haris, Puari, and many others.

Ratans, Jali Bét, 7 Rs. pr. 100 muras (of 75 béts each). Sandi Do. one quarter higher.

Gala ditto, the large kind running from 80 to 120 feet in length, is unsaleable, and therefore only cut to order.

The prices above-mentioned are now current in Kachar; in addition to which the following duties are charged on the transit of the different articles to Sylhet.

|                         | Rs.                           | a. | p.               |
|-------------------------|-------------------------------|----|------------------|
| On Gúndahs,             | 0                             | 6  | 6                |
| On Dúms and Káris, from | 0                             | 6  | 0 to 1 0 6 each. |
| Ratans, from            | 2 to 3 rupees per 100 murahs. |    |                  |

The expence of floating the timbers from the forest to Banga is about 1 R. 4 as. per score, and about the same sum is charged for conveying them to Sylhet; but this expence is more than compensated by the sale of the bambus given gratis by the wood-cutters to form the rafts.

As Jarul is used only in Sylhet, for the construction of large chunam boats, the trade in that article has fallen off greatly of late, in consequence of the stagnation in the lime business, and the annual demand therefore does not now exceed two thousand timbers, which is about one-half the number formerly exported.

From 1500 to 2000 Dúms and Káris form the amount exported of those classes.

Jarul is seldom carried beyond the district of Sylhet in logs, in consequence of the difficulty of floating the timbers across so large a river as the Megna; it is sometimes exported in planks, but more commonly is worked up at Azmeri-ganj, Chattak, and Sanam-ganj into boats, for which, on account of its buoyancy, it is eminently fitted.

A Jarul boat well smeared with béalah will last with occasional repairs about 10 or 12 years, and one of twelve hundred maunds burthen may be built in Kachar for about 350 Rupees. Of the trees sold as Dúms and Káris, there are many which are very strong and durable woods, fit for building and furniture, but which have not yet been introduced to a fair market in consequence of the want of enterprize and capital of the traders.

It is further probable, that as the forests have never been thoroughly examined by any intelligent European, we are still ignorant of many valuable productions which they contain. Besides the Oak and Tún, Chumal, (well fitted for furniture,) Wild Nutmeg, Cinnamon, and Clove trees have, it is said, been seen in them.

T. F.

## VII.—*Recommendations of the Sub-Committees of the British Association for the advancement of Science.*

An abstract of the Proceedings, and a first Report, of the grand Association convened at York in the autumn of 1831, has been published in the Philosophical Magazine of last March. As the suggestions drawn up are of general application, we lose no time in giving them circulation in

India. From an observation under the head of Hygrometry we are glad to find, that Indian labours receive their full share of consideration. There are many points among the desiderata, such as the gradation of temperature with altitude, the diurnal oscillations of the barometer, &c., which are peculiarly easy of elucidation in this climate; and we trust that they will be taken up by some of our friends at *Dehra Dûn, Chirra Punji, &c.* The Association proposes to supply delicate instruments for these observations, and in this respect it might certainly render us eminent service; for it may safely be stated that there is not a standard thermometer or barometer in the country, which can be trusted to reduce our results to terms of a known instrument at home.

It must be confessed, that at first sight the manner in which this new Society proposes to promote the cultivation of the sciences does not appear commensurate with the éclat and grandeur of its foundation; it exerts its persuasion on men eminent in various sciences, to perfect essays and experiments upon which in many cases they state themselves to be already engaged; it invites reports upon the recent progress of every branch of science, but these surely would have been furnished without any such recommendation, and publication would have been ensured free of expence to the authors through the numerous Societies and Periodical Journals already devoted to each division of knowledge. The reports are stated to be only preliminary to measures hereafter to be adopted for advancing and directing future investigations: but the members of such an association composed, as it must be, chiefly of scientific men, are surely aware whither to direct their researches, and unless substantial prizes and rewards are offered, who among them will readily quit the train into which he may have been drawn by taste or circumstances, to pursue a new course of study? A wide class of observers of what is called "the lower order of facts," in Meteorology, Botany, and Zoology may be created, and if well directed, their efforts may certainly prove of great utility; but for the refined examination of the first data of chemistry, of the abstruse questions of mathematical analysis, of astronomical problems, &c. the spontaneous labours of the habitual and secluded devotee will ever command more reliance than the hurried and ostentatious productions of commissioned students and experimenters. We observe that most of the general recommendations of the Society have been zealously taken up by the parties invited to prepare reports for the next meeting; we shall thus have a series of elegant essays, without perhaps much of real novelty, that would not have seen the light as soon in the ordinary way. But although we are not sanguine in our hopes of any brilliant achievement of invention by an association of such a nature, it would be unfair to suppose that it will produce no good results:—"it will cement a general co-operative union of the Philosophical Societies of the country; its publications will form a national catalogue of the scattered particulars of

each science accurately detailed—and if SOCIETIES shall concur in thus meeting each other—in proposing certain common objects—in communicating from year to year the means which they are employing, and the progress which they are making, it *seems impossible* that this should be done in the presence of an assembly concentrating a great part of the scientific talent of the nation, without kindling an increased ardour of emulous activity; it *seems impossible*, that the deputies of any Society should attend such meetings without bringing back into its bosom an enlargement of views, and communicating to its members new lights of knowledge, new motives for inquiry, and new encouragement to perseverance.”

The following are the recommendations of the Sub-Committees, drawn up and circulated after the first meeting.

*Committee of Mathematical and Physical Science.*

*Mathematics.*—The Committee recommend that the Vice-President of the Association residing at Cambridge be requested to use his utmost efforts to procure from some competent individual, a report to the next Meeting on the progress of Mathematical Science.

*Astronomy.*—That Professor Airy be requested to favour the Association with a report on the state and progress of Physical Astronomy, together with such remarks on the improvements of Practical Astronomy as he may deem it useful to add.

*Theory of Tides.*—That J. W. Lubbock, Esq. be requested to furnish a statement of the means which we possess, or which we want, for forming accurate tables for calculating the time and height of High-water at a given place.

*Meteorology.*—That James D. Forbes, Esq. be requested to draw up a report for the next meeting, on the present state of Meteorological Science.

The Committee, considering that the science of Meteorology is in more want than perhaps any other of that systematic direction which it is one great object of the Association to give, has thought it advisable to propose the following points for investigation.

I. That the Association should employ all the means in its power to procure a Register of the Thermometer during every hour of the day and night, to be kept at some military or naval station in the south of England.

*Note\*.*—Until the phenomena and distribution of diurnal temperature are more thoroughly understood than at present, we can hardly hope that any very sure footing has been obtained in the study of Meteorology. The hourly register kept for several years at the military station of Leith Fort in lat. 56°, has shown that we want nothing but the combination of a sufficient number of trust-worthy observations, in order to obtain results of primary importance to the science, and which may one day enable us to arrive at the true form of the daily and annual curves of mean temperature, with a precision almost mathematical. In order, however, to extend the benefit of such investigations, it is

\* The notes appended to the Recommendations have been drawn up by some of the members of the Committees since the meeting.

absolutely necessary that they should be pursued in different latitudes. The mode of rendering available registers, otherwise almost without value from not being made at the proper hours, will be best illustrated by a reference to the account of the Leith observations.—*Transactions of the Royal Society of Edinburgh*, Vol. X.

II. That the establishment of such an hourly Meteorological Register be pointed out as a highly interesting object, in reference especially to the important point of intertropical climate, to the Committee of the Association in India.

III. That the Committee in India be requested to endeavour to institute such observations as may throw light on the phenomena of the horary oscillations of the barometer, near the equator. Should the concurrence of the Committee on these points be obtained, it would probably be desirable that the Association should take measures for sending out delicate and accurate instruments.

IV. That Mr. Phillips and Mr. William Gray, jun. of York, be requested to undertake a series of experiments on the comparative quantities of rain falling on the top of the great tower of York Minster, and on the ground near its base. The Committee has been induced to propose this specific question in consequence of the local fitness of the situation, and the facilities offered for its solution by the authorities; but it is to be wished that similar experiments should be made elsewhere, that, by an extended comparison of observations, light may be thrown upon the anomalies which have been observed at Paris and in other places\*.

V. That the Association should express its desire to receive a satisfactory exposition of the theory of the moistened bulb hygrometer, and that observers be also invited to institute series of comparative experiments on the indications of the moistened thermometer and the temperature of the dew point.

*Note.*—These indications may be ascertained by Mr. Dalton's process, or by Mr. Daniell's hygrometer, or by both. Notwithstanding the ingenious and laborious researches of Hutton, De Saussure, Leslie, Anderson, and Gay Lussac upon this subject, scientific deductions drawn from more extended experiments are greatly wanted. The simplicity and certainty of the experiment by which the cold produced by the evaporation of water is measured, renders an accurate theory of the result peculiarly desirable. The experimenter would do well to consult Mr. Dalton's views on the theory of hygrometry, contained in his Meteorological Essays, and in the Manchester Transactions; and to examine the investigations of Professor Leslie, (*Relations of Heat and Moisture*, and Supplement to the *Encyclopædia Britannica*, article *Meteorology*;) of Dr. Anderson, (*Edinburgh Encyclopædia*, article *Hygrometer*,) and of M. Gay Lussac, (*Biot, Traité de Physique*, Tom. II.) A good series of observations at high temperatures will be found recorded in Nos. II. and III. of a Calcutta Journal, entitled *Gleanings in Science*†.

\* The Ochterlony monument would be a favorable position for a peculiar series of experiments in Calcutta.

† Vide also *Observations in the GLEANINGS*, No. VI. page 47 and 189.

VI. That experiments on the decrease of temperature at increasing heights in the atmosphere be recommended as an important subject for the contributions of observers.

*Note.*—Series of observations for considerable periods of time on the mean temperature of the air at fixed hours, and at stations of which the difference of height has been accurately measured, are the most valuable. The best hours for observations are those which give most accurately the mean temperature of the period of observation. The hourly observations at Leith Fort have determined the hours which give the annual mean temperature in this country to be about 9½ A. M. and 8½ P. M. Experimental balloons have lately been employed by the Earl of Minto, to assist the solution of this problem, which is one of the most interesting in Meteorology: but the investigation of it is nearly brought to a stand for want of sufficiently numerous observations. The observer may be referred for information to Ramond's *Mémoires sur la Formule Barométrique de la Mécanique Céleste*; to the researches of Humboldt; to Professor Leslie, Supplement to the *Encyclopædia Britannica*, Article *Climate*; to Pouillet, *Elémens de Physique*; to Mr. Atkinson's paper on Refractions, in the Memoirs of the Astronomical Society: and to Mr. Ivory's Memoir on the same subject in the Philosophical Transactions, and his papers in the Annals of Philosophy.

VII. That the observation of the temperature of springs at different heights and depths should be pointed out as an object of great interest, in prosecuting which insulated inquirers may render essential aid to science.

*Note.*—When springs are copious, a few observations in the course of the year suffice to give with great accuracy their mean temperature. The height of the springs above the mean level of the sea, and the depth of Artesian wells, should be carefully observed; and where the corresponding mean temperature of the air can be obtained, it should be stated. In two points of view these observations are important, independently of the inference which they may furnish as to the decrease of heat in the atmosphere. The great interest attached to the phenomenon of the progressive increase of temperature of the globe, as we descend through the strata, renders of value observations on the temperature of springs at considerable heights, of springs in mines, and of those brought to the surface from some depths by the process of boring. This question has been treated with great success by M. Cordier in several memoirs, some of which have been translated into English. Again, the researches of Humboldt, Buch, Wahlenberg, and more recently Kupffer, in a Memoir on Isogeothermal Lines, read before the Academy of St. Petersburg in 1829, have shown that the temperature of the earth differs in many parts of the globe from that of the air, being generally in defect below lat. 56°, and in excess beyond it. Artesian wells, and the deviation of the mean temperature of the earth from that of the air in different latitudes, have opened new fields for discussion; and by the zealous co-operation of observers cannot fail to present results, of which at present we can form but an imperfect idea.

*Magnetism.*—It appears to the Committee highly desirable, that a series of observations upon the intensity of terrestrial magnetism in various parts of England be made by some competent individual, similar to those which have recently been carried on in Scotland, by Mr. Dunlop.



Should the Committee succeed in finding some individual ready to undertake the task, they propose that an application should be made to the Royal Society of Edinburgh, for permission to make use of the standard needle belonging to them, and constructed under the direction of Professor Hansteen of Christiania.

It appears to the Committee of considerable importance that a certain number of observations should be made throughout Britain with the dipping needle, in order to reduce the horizontal to the true magnetic intensity.

*Note.*—The time of three hundred vibrations should be observed, and the methods of observation and reduction should be the same as have been employed and described by Humboldt, Hansteen, and others.

*Electro-Magnetism.*—The Committee recommend as an important subject for further prosecution, the examination of the electro-magnetic condition of metalliferous veins. The Committee would refer for the details of what has been already done upon this subject, to the paper of Mr. Fox in the Philosophical Transactions for 1830, and would propose that the experiments should be extended to veins which traverse, as in some of our mines, horizontal and dissimilar strata.

*Optics.*—That Dr. Brewster be requested to prepare for the next meeting a report on the progress of optical science.

*Acoustics.*—That the Rev. Robert Willis be requested to prepare for the next meeting a report on the state of our knowledge concerning the phenomena of sound, and the additions which have been recently made to it.

*Heat.*—That Professor Powell be requested to prepare for the next meeting a similar report respecting heat.

*Electricity.*—That Professor Cumming be requested to prepare for the next meeting a similar report on thermo-electricity, and the allied subjects, in which recent discoveries have been made.

#### *Chemical Committee.*

It appears to the Committee of supreme importance, that chemists should be enabled, by the most accurate experiments, to agree in the relative weights of the several elements, hydrogen, oxygen, and azote, or, which amounts to the same thing, that the specific gravity of the three gases should be ascertained in such a way as would insure the reasonable assent of all competent and unprejudiced judges.

They think it highly desirable, that the doubts which remain respecting the proportions of azote, oxygen, &c. in the atmosphere should be removed; that the proportions of azote and oxygen in nitrous gas and nitrous oxide should be strictly determined; and that the specific gravities of the compound gases in general should be more accurately investigated.

They recommend that the members of this Committee, and British chemists in general, be invited to make experiments on these subjects, and communicate their results to the next meeting at Oxford.

That Mr. Johnston be requested to present to the next meeting a view of the recent progress of chemical science, especially in foreign countries.

That Dr. Daubeny be requested to undertake an investigation into the sources from which organic bodies derive their fixed principles.

That Mr. Johnston be requested to undertake the inquiries which have been suggested to the Committee, into the comparative analysis of iron in the different stages of its manufacture.

That Mr. West be requested to pursue the experiments contemplated by him into the combinations of gaseous bodies when passed through heated tubes.

That the Rev. W. Vernon Harcourt be requested to prosecute the inquiries contemplated by him into the chemical phenomena from which the materiality of what are sometimes called ethereal substances has been inferred.

*Mineralogical Committee.*

The Committee recommend, that the Rev. Professor Whewell be requested to present to the next meeting a report on the state and progress of Mineralogy.

*Geological and Geographical Committee.*

The Committee recommend, that geologists be requested to examine strictly into the truth of that part of the theory of M. Elie de Beaumont, in its application to England, Scotland, and Ireland, which asserts that the lines of disturbance of the strata assignable to the same age are parallel, and that a report to the next meeting on this subject should be procured.

That Mr. Phillips be requested to draw up, with such co-operation as he may procure, a systematic catalogue of all the organized fossils of Great Britain and Ireland, hitherto described, with such new species as he may have an opportunity of accurately examining, with notices of their localities and geological relations.

The Committee propose, that Mr. Robert Stevenson, civil engineer, be requested to prepare a report upon the waste and extension of the land on the east coast of Britain, and the question of the permanence of the relative level of the sea and land; and that individuals who can furnish observations be requested to correspond with him on the subject.

*Note*—The importance which, (especially of late years, has been attached to facts of this nature, in illustration of the sciences of hydrography and geology, and the mass of uncombined materials which have recently been accumulating, have induced the Committee to make the present recommendation; and in doing so, it feels pleasure in being able to have in its view an individual whose practical acquaintance with the coast in general, and more particularly the minute survey made by him some years since, gives reason to expect from his report much important and accurate information.

*Botanical Committee.*

The Committee recommend, that Professor Lindley be requested to prepare for the next meeting an account of the principal questions recently settled, or at present agitated, in the philosophy of Botany, whether in this country or abroad:

That botanists in all parts of Great Britain and Ireland be invited to compose and communicate to the meetings of the Association catalogues of county or other local Floras, with indications of those species which have been recently introduced, of those which are rare or very local, and of those which thrive, or which have become or are becoming extinct, with such remarks as may be useful towards determining the connection which there may be between the habitats of particular plants, and the nature of the soil and the strata upon which they grow; with statements of the mean winter and summer temperature of the air and water at the highest as well as the lowest elevation at which species occur, the hygrometrical condition of the air, and any other information of an historical, æconomical, and philosophical nature.

*Note*.—If upon this plan a complete botanical survey of the British islands could be obtained, the results would be important when the Flora in the aggregate came to be compared with its relations of soil, climate, elevation, &c.

## Catalogue of Indian Birds.

[Continued from p. 267.]

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**CINCLOSOMA CAPISTRATUM.** *Cinclos.* capite suprà, genis, pteromatum maculâ rectricibusque ad basin intensè atris; remigum pagoniis externis, rectricum apicibus, tectricibusque alarum fusco-griseis, his fasciâ albâ notatis; dorso medio pallidè brunnescenti-griseo; collo in fronte, nuchâ, pectore, abdomineque summo pallide, dorso abdomineque imis saturatiùs, rufis.

Rostrum nigrum, pedes flavescentes. Remiges interiores, rectricumque mediarum bases rufi. Longitudo corporis, 10; alæ a carpo ad apicem remigis 6tæ, 4; rostri, 1 $\frac{1}{8}$ ; tarsi, 1 $\frac{3}{8}$ ; caudæ, 4 $\frac{1}{2}$ .

**CINCLOSOMA VARIEGATUM.** *Cinclos.* strigilâ a rictu per oculos extendente, mento colloque in fronte, maculâ pteromatum et mediâ alarum, rectricumque mediarum basibus atris; fronte, strigilâ genarum infrà, pectoreque pallidè albescenti-rufis; notâ pteromatum, abdomine crissoque rufis; capite suprà, nuchâ, dorsoque brunnescenti-griseis; alarum pagoniis externis, rectricumque mediarum quatuor apicibus cinereo-griseis; rectricibus quatuor utrinque lateralibus externè flavo-olivaceis, apicibus albis.

Rostrum nigrum, pedes rubri. Longitudo corporis, 11; alæ a carpo ad apicem remigis 6tæ, 4; rostri, 1 $\frac{1}{6}$ ; tarsi, 1 $\frac{3}{8}$ ; caudæ, 4 $\frac{1}{2}$ .

**CINCLOSOMA LINEATUM.** *Cinclos.* capite suprà, nuchâ, dorso imo, rectricibusque duobus mediis brunnescenti-griseis; regione post-oculâri, dorso summo, corpore infrà, rectricibusque lateralibus pallescenti-rufis; his fasciâ nigrâ pone apicem album notatis; capitis nuchæque plumis in medio lineis fuscis, pectoris dorsique summi lineis pallidis, per totam rhachin longitudinem graciliter strigatis.

Rostrum pedesque flavescentes. Longitudo corporis, 9 $\frac{1}{2}$ ; alæ a carpo ad apicem remigis 6tæ, 3 $\frac{1}{2}$ ; rostri, 1 $\frac{7}{8}$ ; tarsi, 1; caudæ, 3 $\frac{1}{2}$ .

Genus *Timalia*.

47. **TIMALIA CHATAREÆ.** *Tim.* suprà pallidè brunnescenti, subtùs rufescenti-cinerea; capite corporeque suprà lineis fuscis striatis; rectricibus fusco obsolete fasciatis; rostro pallido.

Longitudo 9 $\frac{1}{2}$ .*Gogoye Thrush*, Lath.?

48. **Timalia pileata**, Horsf. *Pileated Thrush*, Lath.

49. **TIMALIA HYPOLEUCA.** *Tim.* suprà rufescenti-brunnea, subtùs alba; alis rufis; his caudæque subtùs cinereis, rectricibus fusco obsolete fasciatis; rostro nigro.

Longitudo 6 $\frac{1}{2}$ .

50. **TIMALIA HYPERYTHRA.** *Tim.* suprà olivascanti-brunnea; capite in fronte corporeque toto subtùs rufis; caudâ supernè fusco obsolete fasciatâ; rostro pallido.

Longitudo 5.

Genus *Ixos*.

51. **Ixos jocosus.** *Lanius jocosus*, Linn. *Jocose Shrike*, Lath.

52. **Ixos Cifer.** *Turdus Cifer*, Linn. *Cape Thrush*, Lath. *Le Courouge*, Le Va. ill.

53. **Ixos fulicata.** *Motacilla fulicata*, Linn. *Sooty Warbler*, var. Lath.

*Traquet noir des Philippines*, Buff.Fam. *Sylviadæ*.—Genus *Iora*.

54. **Iora scapularis**, Horsf. *Scapular Wagtail*, Lath.

Genus *Sylvia*.

55. *Sylvia Hippolais*, Lath. Ind. Orn. *Lesser Pettichaps*, Lath. *Reed Wren*, Lath.  
This is the bird alluded to under Dr. Latham's *Reed Wren*, as an Indian variety called *Tikra* and *Tiktikl*.

Genus *Prinia*.

56. *PRINIA CURSITANS*. *Prin.* corpore, suprà pallidè brunnea, fusco striato; gulà juguloque albis; abdomine rufescente; rectricibus mediis fuscis, omnibus subtilus ad apicem fascià nigrà albo terminatà notatis.  
Longitudo 4.
57. *PRINIA MACROURA*. *Prin.* suprà grisescenti-brunnea; capite, alis, uropygioque subrufescenti tinctis; subtilus ferrugineo-albida; rectricibus quatuor mediis saturatioribus fusco obsoletè fasciatis, subtilus ad apicem fusco leviter notatis.  
Longitudo 5½.
58. *PRINIA GRACILIS*. *Prin.* cinereo-grisca; dorso, alis, caudàque olivascentibus; gulà, pectore, abdomineque subtilus albidis; rectricibus subtilus griseis fascià nigrà albo terminatà notatis.  
Longitudo 4 1⁄8.  
*Foodkey Warbler*, Lath ?

Genus *Motacilla*.

59. *MOTACILLA PICATA*. *Mot.* capite, collo, corporeque supra nigris; strigà utrinque superciliari uteràque longitudinali alarum, corpore subtilus, rectricibusque duabus lateralibus albis.  
Longitudo 9.  
*Pied Wagtail*, Lath. pl. 104.
60. *Motacilla flava*, Linn. *Bergeronnette jaune*, Buff. & *Bergeronnette de printemps*, Buff. *Yellow Wagtail*, Lath.  
This is the Indian bird alluded to by Dr. Latham under the head of *Yellow Wagtail*, called *Preluck*, which is its Indian name.

Genus *Enicurus*.

(Hitherto considered limited to the Indian archipelago.)

- ENICURUS MOCULATUS*. *En.* capite, collo, dorso superiori, pectore, ptilis, remigibus secundariis caudàque intensè atris; frontis notà latà, maculis confertis nuchæ et sparsis dorsi, pteromatibus, dorso, imo, abdomine, rectricibus lateralibus, mediarumque apicibus albis; remigibus primariis fuscis; rostro nigro pedibus albescentibus.  
Staturà, *En. specioso* æqualis.

Genus *Saxicola*.

61. *Saxicola rubicola*, Temm. *Stone Chat Warbler*, Lath.

Genus *Phenicura*.

62. *Phenicura atrata*, Jard. & Selb. *Indian Redstart*, Id.  
*PHENICURA CÆRULEOCEPHALA*. *Phæn.* atra, abdomine strigàque alarum longitudinali albis; capite pallide cæruleo.  
Staturà, *Phæn. communi*.  
*PHENICURA LEUCOCEPHALA*. *Phæn.* corpore apiceque caudæ atris; abdomine, crisso, uropygio, rufis; capite supra albo. Staturà *Phæn. rubeculæ*.  
*PHENICURA RUBECULOIDES*. *Phæn.* capite, collo, corporeque supra atro-cæruleis, capitis summo splendidiore; abdomine albo; pectore rufo.  
Staturà, *Phæn. cæruleocephalæ*.

*PHENICURA FULIGINOSA.* *Phæn. corpore fuliginoso-plumbeo; caudâ rufâ.*  
*Staturâ paullo major quam præcedens.*

Fam. *Pipridæ*.—Genus *Parus*.

63. *Parus atriceps*, Horsf. *Mésange cap-nègre*, Temm.

*PARUS XANTHOGENYS.* *Par. capite cristato, gulâ, pectore, abdomine medio, strigâ utrinque colli, scapularium maculis, alis, caudâque atris, his albo notatis; dorso scapularibusque virrescenti-griseis; genis, strigâ superciliari, maculâ nuchali, abdominisque lateribus flavis.*

*Staturâ præcedentis.*

*PARUS MELANOLOPHUS.* *Par. griseus; capite cristato pectoreque atris; genarum, nuchæ, tegminumque alarum maculis albis; remigibus rectricibusque fuscis; maculâ sub alis rufâ.*

*Staturâ Par. atro paulo minor.*

*PARUS EBYTHROCEPHALUS.* *Par. supra pallidè brunnescenti-canus, subtus rufescenti-albus; gulâ, strigâ superciliari, rectricumque lateralium pogoniis externis albis; capite supra rufo; strigâ latâ per oculos ad nucham extendente, thoraceque atris.*

*Staturâ Par. pendulini, Linn.*

*PARUS MONTICOLUS.* *Par. capite, collo, pectore, abdomine medio, alis, rectricibusque atris; genarum maculâ latâ nuchaliqve parvâ, tegminum remigum secundariorum rectricumque apicibus, et remigum primariorum rectricumque lateralium pogoniis externis albis; abdominis lateribus flavis.*

*Staturâ paulo minor Par. majori.*

Tribus *CONIROSTRES*.

Fam. *Fringillidæ*.—Genus *Alauda*.

64. *ALAUDA CHENDOOLA.* *Al. suprâ pallidè grisescenti-brunnea, plumis fusco in medio notatis; corpore subtilis strigâque superciliari albis; rectricibus brunneis, duarum utrinque lateralium pogoniis externis albis; pectore brunneo maculato, capite cristato.*

*Staturâ Al. arvensis, Linn.*

65. *ALAUDA GULGULA.* *Al. pallidè rufescenti-brunnea, plumis in medio latè et intensè brunneo lineatis; subtilis albescens, pectore brunneo lineato; femoribus rufescentibus; rectricibus brunneis, externâ utrinque ferè totâ, secundâ pogonio externo, albis.*

*Staturâ ferè præcedentis.*

Genus *Mirafra*.

66. *Mirafra Javanica*, Horsf. *Alouette mirafre*, Temm.

67. *MIRAFRA PHENICURA.* *Mir. pallidè cinereo-brunnea; corpore subtilis, remigum pogoniis internis, rectricumque basi rufis; rostro albo, culmine apiceque fuscis.*

*Longitudo 5.*

Genus *Emberiza*.

68. *Emberiza Baghaira.* *Baag-geyra Lark*, Lath.

This bird is the common *Ortolan* of India, called *Baghairi*.

69. *Emberiza Gingica*, Gmel. *Duree Finch*, Lath.

70. *Emberiza cristata*, Gould's Century of Himalayan Birds.

71. *Emberiza Bengalensis.* *Baya Berbera*, Asiat. Res. *Loxia Bengalensis*, Linn.

The Hindu name of this bird is *Baya*; its Sanscrit name *Berbera*.

EMBERIZA CRISTATA. Mas. *Emb. capite cristato corporeque atris; alis caudâque rufis.*

Fœm. aut Mas juv. ? *Capite subcristato corporeque fuscis, abdomine imo pallidiori; alis caudâque rufescentibus, fusco tinctis.*

Staturâ *Carduelis communis.*

CARDUELIS SPINOIDES. Mas. *Card. fronte, occipite, collo corporeque infra, ptilis, pteromatum apicibus, fasciâ remigum, rectricumque lateralium basibus flavis; capite supra dorsoque olivaceis; alis caudâque fuscescenti-nigris.*

Fœm. ? *Coloribus minoribus saturatis; abdomine dorsoque olivaceo-fusco striatis.*

Staturâ paulû major quâm *Card. Spini.*

CARDUELIS CANICEPS. *Card. brunnescenti-canus; alis caudâque nigris; circulo angusto frontem rictum gulamque circumcingente coccineo; fasciâ alarum aureâ; thorace, maculi: paucis alarum, uropygio, abdomine imo, crisso, rectricum externarum pogoniis internis, mediarumque apicibus ulbis.*

Staturâ *Card. communis.*

#### Genus *Fringilla.*

72. *Fringilla Amandava*, Linn. *Lc Bengali Piqueté*, Buff.

73. *Fringilla formosa*, Lath. *Lovely Finch*, Lath.

74. *Fringilla Malabarica*, —. *Loxia Malabarica*, Linn. *Malabar Grosbeak*, Lath.

75. FRINGILLA FLAVICOLLIS. *Fring. suprâ cinereo-grisea, subtus albida; jugulo maculâ flavâ notato; humeris ferrugineis; alis maculis albis fascias duas exhibentibus notatis.*

Longitudo 5 $\frac{1}{2}$ .

This bird, though placed amongst the *Finches*, differs in the form of its bill, and it may perhaps hereafter be found expedient to remove it.

FRINGILLA RODOPEPLA. *Fring. suprâ brunnea; capite, nuchâ, dorsoque lineis fuscis rosaceoque nitore notatis; strigâ utrinque superciliari, gulâ, thorace, maculis alarum, uropygio, corporeque subtus rosaceis.*

Longitudo circiter 7 uncias.

FRINGILLA RODOCHROA. *Fring. supra brunnea; capite, nuchâ, dorsoque lineis fuscis, illo rosaceo tinctis; fronte, strigâ utrinque superciliari, gulâ, pectore, corpore subtus, uropygioque rosaceis; alis immaculatis.*

Longitudo circiter 5 $\frac{1}{2}$  uncias.

#### Genus *Coccothraustes:*

*Coccothraustes icteroides.* Mas. *Cocc. capite, jugulo, dorso medio, alis, femorum tectricibus, caudâque atris; nuchâ uropygio, corporeque subtus luteis.*

Fœm. *Olivaceo-cana, uropygio abdomineque lutescentibus; remigibus rectricibusque atris.*

#### Genus *Ploceus.*

76. *Ploceus Philippinus*, Cuv. *Philippine Grosbeak*, Lath.

Fam. *Sturnidæ*.—Genus *Pastor.*

77. *Pastor roseus*, Temm. *Rose-coloured Thrush*, Lath. *Le Rosclin*, Le Vaill.

78. *Pastor tristis*, Temm. *Merle des Philippines*, Buff.

79. *Pastor griseus*, Horsf. *Le Martin gris de fer*, Le Vaill.

80. *Pastor Contra* vel *Capensis*, Temm. *Etourneau Pie*, Buff.

81. *Pastor Pagodarum*, Temm. *Le Martin Brâme*, Le Vaill.

Fam. *Corvidæ*.—Genus *Corvus*

82. *Corvus Corone*, Linn. *Carriion Crow*, Lath.

This bird appears to be the common *Carrier Crow* of India; it differs only in size from the European *Crow*, and in the greater elevation of the bill.

Genus *Coracias*.

- 83. *Coracias Bengalensis*, Linn. *Blue Jay from the East Indies*, Edw.

Genus *Pica*.

84. *Pica vagabunda*, Wagler. *Rufous Magpie*, Hardw.

Genus *Garrulus*.

*GARRULUS LANCEOLATUS*. *Garr. vinaceo-badius; capite subcristato, gula, jugulo, alisque atris; collo anteriori albo, lanceolati; pteromatibus remigibusque cæruleo fasciatis, illis albo terminatis; cauda cærulea, nigro fasciatâ: fasciâ lata apicali albo terminatâ notatâ.*

*GARRULUS BISPECULARIS*. *Garr. pallidè badius, uropygio crissoque albis; maculâ lâtâ poststrictali, caudâ, pteromatibus, remigibusque atris; his duabus cæruleo fasciatis.*

*GARRULUS STRIATUS*. *Garr. pallidè brunneus, subtus pallidior; corporis suprà subtusque plumis in mediò albo longitudinaliter striatis; cristâ verticali remigibus, rectricibusque unicoloribus.*

This latter species was observed to deviate in general colour and markings from the European species, although according in form; and in the former characters to exhibit a manifest approach to the *nut-crackers* or the genus *nucifraga* of Brisson.

Genus *Nucifraga*.

*NUCIFRAGA HEMISPILA*. *Nuc. castaneo-brunnea; capite subtus, collo anteriori, dorso, pectoraque albo maculatis; capite summo, alis, rectricibusque intensè brunneis; his, duabus mediis exceptis, ad apicem latè albis.*

This new species, in the shape of the bill, is shorter and stouter at the base than in the European species, and approaches to the *Jays*.

Fam. *Buceridæ*.—Genus *Buceros*.

85. *Buceros Gigasianus*, Lath. *Indian Hornbill*, Lath.

There is some confusion with regard to this bird in Dr. Latham's General History, under the heads of *Gingi* and *Indian Hornbill*: it is the *Dhanésa* of India.

86. *Buceros Malabaricus*, Gmel. *Unicorn Hornbill*, Lath.

There is also much confusion with regard to this bird under the heads of *Pied Hornbill* and *Unicorn Hornbill* of Latham: it is the *Dhanésa* of the latter, var. B.

Tribus *SCANSORES*.

Fam. *Pittacidæ*.—Genus *Palæornis*.

87. *Palæornis torquatus*, Vig. *Psittaca Borbonica torquata*, Briss. *La Perruche à double collier*, Buff.

88. *Palæornis Bengalensis*, Vig. *Psittacus Bengalensis*, Gmel. *Blossom-headed Parakeet*, Lath. sp. 74. var. A.

89. *PALÆORNIS FLAVICOLLARIS*. *Pal. viridis; capite lilacino-cano, flavo marginato; rectricibus mediis cæruleis apice albo.*

Longitudo 12.

According to the description, this would appear to be Dr. Latham's *yellow-collared Parakeet*; but he refers to figures which do not correspond.

Genus *Psittacula*.

**PSITTACULA RUBIFRONS.** *Psitt. viridis, subtus pallidior; fronte, dorso imo, rectricumque tectricibus coccineis; remigibus caudâque viridi-fuscis, rostro subelongato rufo.*

Staturâ puellô major quàm *Psitt. Galguli*.

Fam. *Picidæ*.—Genus *Bucco*.

90. **BUCCO CANICEPS.** *Buc. gramineo-viridis; capite, nuchâ, collo, pectoreque griseis; illius plumis in medio albido lineatis; rostro rubro; pedibus flavis; regione circumoculari nudâ flavescenti-rubrà.*

Longitudo 10.

*Fichte's Barbet*, Lath.?

This bird is the *Bara-Basanta* of India, and appears to be the same as var. A. of Dr. Latham's *Fichte's Barbet*.

91. **Bucco Philippinensis**, Gmel. *Barbu des Philippines*, Buff.

Genus *Picus*.

92. **PICUS Bengalensis**, Linn. *Bengal Woodpecker*, Lath.

93. **PICUS Mahrattensis**, Lath., Ind. Orn. *Mahratta Woodpecker*, Lath.

**PICUS HYPERYTHIRUS.** *Mas. Pic. corpore supra nigro, albo-maculato, subtus rufo-fuscescenti-budio; capite crissoque coccineis; strigâ utrinque per oculos extendente albâ; mandibulâ superiori nigrâ, inferiori albâ.*

Fœm. *Capite nigro albo-lineato.*

Staturâ *Pic. medii*, Linn.

**PICUS OCCIPITALIS.** *Mas. Pic. viridis, uropygio lutescenti; fronte coccineo; vertex strigâ latâ occipitali ad nucham extendente, alterâque utrinque sub oculos postrientali atris; remigibus rectricibusque fusco atris, parum duabus mediis pallido-fusco striatis, illis externè albo maculatis; gulâ genisque canis. Fœm. Fronte atrâ albo lineatâ.*

**PICUS SQUAMATUS.** *Pic. supra viridis, uropygio sublutescenti; gulâ juguloque viridi-canis; capite coccineo; strigâ superoculari, abdomineque viridi albis, hoc atro squamato; strigâ superciliari alterâque utrinque mentali atris; remigibus rectricibusque fusco atris, illis externè, his utrinque albo maculatis.*

**PICUS SPILOLOPHUS.** *Pic. dorso alisque sanguineo-coccineis; subtus sordidè albus, fuscescenti undulatus; capite colloque nigris, guttis albis maculatis; hujus maculis grandioribus; remigibus caudâque fuscis, harum pogoniis internis albo maculatis.*

Longitudo corporis, 11½.

**PICUS MODESTUS.** *Pic. supra ater, alis ad latera apicesque subrufescentibus; capite in fronte genisque obscurè coccineis, occipite, gulâ, jugulo, colloque griseiscenti-atris, plumis macula minutissimâ albâ ad apicem terminatis; rectricibus duabus mediis elongatis.*

Longitudo corporis, 15; alæ u. carpo ad apicem remigis 4tæ, 6; caudæ, 6; tarsi, 1; rostri, 1½.

**PICUS ALRICEPS.** *Mas. Pic. capite supra aureo; occipite, abdomine imo, crissoque, coccineis; colli parte posteriori et strigâ utrinque laterali, corporeque supra nigris; colli parte frontali et lateribus, corporeque infra albis, hoc nigro striato; scapularibus, pteromatibus, remigibus, rectricibusque lateralibus albo-maculatis; dorso medio griseo, albo nigroque fasciato.*

Fœm. *Sine notâ coccinea occipitali.*

Staturâ *Pic. medii*.

**PICUS PYGMÆUS.** *Mas. Pic. capite supra dorsoque medio griseo-canis, hoc albo nigroque fasciato; strigâ utrinque per oculos ad nucham extendente, gulâ, maculisque pteromatum remigum et rectricum lateralium albis; pectore abdomine-*



*que albescentibus, fusco graciliter striatis; notâ longitudinali gracili utrinque post oculos coccineâ.*

- Form. *Sine notâ coccineâ postoculari.*

Statuâ minor quam *Pic. minoris.*

Fam. *Certhiadae*.—Genus *Sitta*.

- 94. *SITTA CASTANEOVENTRIS*. *Sit. supernè griseo-plumbea; pectore abdomineque castaneis; strigâ a rictu per oculos ad nucham extendente, remigibus, rectricumque pogonis internis nigris; gulâ maculâque rectricum lateralium albis.*

Longitudo 5.

*Ferruginous-bellied Nuthatch*, Lath.?

Genus *Certhia*.

95. *CERTHIA SPILONOTA*. *Certh. supra griseo-fusca, albo maculata; capite albo graciliter striato; gula abdomineque albidis, hoc fusco fasciato; caudâ albo fuscoque fasciata.*

Longitudo 5½.

The tail of this bird is soft and flexible, in which respect it differs from the type of the genus; but it agrees in all others.

Genus *Upupa*.

96. *Upupa minor*, Shaw. *La Huppe d' Afrique*, Le Vaill.

Fam. *Cuculida*.—Genus *Leptosomus*.

97. *Leptosomus Afer*. *Cuculus Afer*, Gmel. *Edolian Cuckow*, Shaw.

Genus *Cuculus*.

98. *Cuculus canorus*, Linn. *Common Cuckow*, Lath.

This bird, on comparison with the *common Cuckow*, differs so little that it can scarcely be called a variety; it is the *common Cuckow* of India, and its habits and note resemble those of the European bird.

99. *Cuculus fugax*, Horsf. *Bychan Cuckow*, Lath.

The common Indian name of this bird is *Pipihâ* or *Pipeeha*, from its note; in Sanscrit *Chataca*. Dr. Buchanan named it *Cuculus radiatus*.

100. *Cuculus Sonneratii*, Ind. Orn.? *Le petit Coucou des Indes*, Sonn.? *Sonnerat's Cuckow*, Lath.?

Not having either specimen or figures to refer to, I conclude, from description alone, that this bird is *Sonnerat's Cuckow*.

Genus *Centropus*.

101. *Centropus Philippensis*, Cuv. *Coucou des Philippines*, Buff. *Chestnut Coucal*, Lath.

Genus *Lampromorpha*.

*LAMPROMORPHA AMETHYSTINA*. *Lamp. supra splendide amethystina; abdomine albo, fasciis viridi-amethystinis ornato; rect. icibus lateralibus albo notatis.*

Longitudo 7½.

This description is taken from a bird in the state of change, the amethystine feathers on the back, tail and breast, appearing partially through a ferruginous ground, but sufficiently numerous and defined to indicate the adult plumage. A younger bird in the collection has nearly the whole of the upper body ferruginous, with an amethystine feather here and there breaking out. In a note appended to the description of the species, Mr. Lindsay states that the natives considered them of extremely rare occurrence.

The male exhibited of this species was observed to have the two middle tail feathers elongated beyond the rest, and the lateral feathers were shown to be altogether soft and flexible, like those of the genus *Picumnus*, Temm.

This bird is the *Mahooka* of India, so named from its note; it is called also, by the English, *Pheasant Crow*. Dr. Latham's *chestnut Coucal* very accurately describes it, but his figure is bad; having apparently been taken from a drawing of Gen. Hardwicke's, which stated it to be a young bird. Dr. Buchanan named it *Cuculus castaneus*.

Genus *Eudynamys*.

102. *Eudynamys Orientalis*. *Cuculus Orientalis*, Linn. *Eastern black Cuckow*, Lath.  
*Coucou noir des Indes & Coukeel*, Buff.

This bird is the *Coel* of India, and the *Coukeel* of Buffon.

103. *Eudynamys Sirkee*. *Centropus Sirkee*, Hardw. *Sirkeer Cuckow*, Lath.

## Tribus TENUIROSTRES.

Fam. *Meliphagidæ*.—Genus *Chloropsis*.

104. *Chloropsis aurifrons*, Jard. & Selby. *Malabar Chloropsis*, Jard. & Selby.

This bird is the *Hurêwa* of India, and is well described by Dr. Latham as the *Hurruwa Bee-eater*.

Fam. *Cinnyridæ*.—Genus *Cinnyris*.

105. *CINNYRIS ORIENTALIS*. *Cinn. capite, collo, dorsoque splendide virescenti-purpureis; abdomine purpureo-atro; alis caudaque atris; fasciculo utrinque sub alis aurantiaco.*

Longitudo 4.

*Eastern Creeper*, Lath.

*CINNYRIS GOULDIÆ*. *Cinn. capite supra, gula colloque in fronte, regione auriculari, striga utrinque graciù ad latera colli usque ad humeros extendente, uropygio, caudæ tectricibus, rectricibusque duabus mediis elongatis purpureo et cæruleo metallicè splendentibus; capitis lateribus, occipite, nucha, scapularibus, dorso summo, ptilisque sanguineo-rubris; dorso imo, pectore, abdomineque sulphureis, his sanguineo sparsis; remigibus rectricibusque lateralibus fuscis.*

Longitudo circiter 5 uncias.

This species has been dedicated by Mr. Vigors to the accomplished artist, Mrs. Gould, who executed the plates of the Himalayan birds.

## ORDO III. RASORES.

## Fam. COLUMBIDÆ.

Genus *Vinago*.

106. *Vinago militaris*. *Columba militaris*, Temm. *Columbar Commandeur*, Temm.  
*Hurrial Pigeon*, Lath.

Genus *Columba*.

107. *Columba tigrina*, Temm. *Colombe à nuque perlée*, Temm.

108. *Columba Cambayensis*, Gmel. *Colombe maillée*, Temm.

109. *Columba risoria*, Linn. *Colombe Blonde*, Temm. *La Tourterelle Blonde*,  
Le Vaill.

Le Vaillant mentions a larger bird of this species which is common in Africa; the same thing occurs also in India, where there are two birds differing only in size.

110. *Columba humilis*, Temm. *Colombe terrestre*, Temm.

*COLUMBA LEUCONOTA*. *Col. capite canescenti-atro; crisso caudaque nigris; nucha, corpore subtus, dorso medio, caudæque fasciâ latâ mediâ, albis; tegminibus alarum vinaceo canis; dorso superiori scapularibusque brunnescenti-canis; remigibus, fasciisque alarum brunnescenti-fuscis.*

*Statuâ Col. Palumbi*, Linn.

## Fam. PHASIINIDÆ.

Genus *Pavo*.

111. *Pavo cristatus*, Linn. *Le Paon*, Buff. *Crested Peacock*, Lath.

Genus *Tragopan*.

112. *Tragopan Satyrus*, Cuv. *Meleagris Satyrus*, Linn. *Horned Pheasant*, Lath.

*TRAGOPAN HASTINGSII*. *Trag. dorso brunneo-fusco undulato, abdomine intensè rubro, amborum plumis ad apicem nigris in medio albo guttatis; cristâ crissoque atris, illâ ad apicem coccineâ, hoc albo maculato; collo posteriori coccineo; thorace aurantio; regione circum oculari nudâ, curunculisque pendentibus luteis; caudâ atrâ, lutescenti-albo undulatâ.*

This is a second species of the singular group of *Horned Pheasant* (*Meleagris Satyra* of Linnæus), peculiar to India.

Genus *Phasianus*.

- **PHASIANUS ALBO-CRISTATUS.** Mas. *Phas. supra ater, viridi nitore splendor; dorso imo albo fasciato; cristæ plumis albis, elongatis, deorsim recumbentibus, basi subfuscis; remigibus corporeque inferiori fuscis; pectoris plumis lanceolatis albescentibus.*

Fœm. *Corpore supra cristâque breviori, fuscescenti-brunneis; abdomine pallidior; gula plumarumque corporis apicibus et rhacibus albescentibus; rectricibus lateralibus atris, mediis brunneis albescenti undulatis.*

This is the true pheasant, indicated only by former writers from imperfect drawings and descriptions.

**PHASIANUS STACEII.** *Phas. stramineo-albus, supra frequenter, subtus parçè nigro fasciatus, dorso abdomineque imis rufescentibus; capite cristato fusco; caudâ fasciis latis nigris, ad basin internè rufis, ornata.*

Longitudo corporis ab apice rostri ad apicem caudæ, 3 pedes 4 uncias.

**PHASIANUS LINEATUS,** Lath. MSS. *Phas. supra cano griseus; fasciis gracilibus nigris undulatus; capite, cristâ elongatâ, guli, collo anteriori, corporeque infra nigris; abdominis laterum plumis in medio lineis gracilibus albis notatis; caudâ albo nigroque undulatim sparsâ.*

Fam. TETRAONIDÆ.

Genus *Pterocles*.

113. *Pterocles exustus*, Temm. *Ganga ventre-brûlé*, Temm.

Genus *Francolinus*.

114. *Francolinus Ponticerianus*, Temm. *Francolin à rabat*, Temm.

115. *Francolinus vulgaris*, Steph. *Le Francolin*, Buff. *Francolin*, Edw.

Genus *Perdix*.

116. *Perdix picta*, Jard. & Selby. *Painted Partridge*, Id. *Beautiful Partridge*, Lath.

117. *Perdix Hardwickii*, Gray. *Curra Partridge*, Lath.

118. *Perdix Cambayensis*, Temm. *Perdrix rousse-gorge*, Temm.

Genus *Coturnix*.

119. *Coturnix dactylisonans*, Meyer. *Common Quail*, Lath.

This bird is named *Chagul*; it corresponds with the European species, and is not very common in India.

120. *Coturnix Coromandelica*. *Perdix Coromandelica*, Lath. *Perdix textilis*, Temm. *Caille nattée*, Temm.

This is the most common *Quail* of India, called *Bhuteir*. Dr. Buchanan named it *Perdix olivacea*.

Genus *Hemipodius*.

121. *Hemipodius Dussumier*, Temm. *Turnix Dussumier*, Temm. *Mottled Quail*, Lath.

Fam. STRUTHIONIDÆ.

Genus *Otis*.

122. *Otis Indica*, Ind. Orn.? *White-chinned Bustard*, Lath.?

This bird has usually been considered as the female of the *Otis auriga*, and has been so figured and described; but it is well known to be a distinct bird. It is the common *Leek* of India, called by the English *Bastard Florican*. I am not quite certain that Dr. Latham's *White-chinned Bustard* is the bird, but his description is so near, that I have not thought it proper to make it a new species.

**OTIS NIGRICEPS.** *Ot. corpore supra pallidè hadio, rufo-brunneo graciliter undulato; collo, maculis parvis alarum, abdomineque albis; capite cristato, tectricibus alarum exterioribus, remigibus, notâque grandi pectorali nigris.*

Longitudo corporis ab apice rostri ad apicem caudæ, pedes 4; latitudo, 4½.

- **OTIS HIMALAYANUS.** *Ot. niger; alis albis; dorso medio scapularibusque pallido-rufo, brunneoque variegatis; dorso imo pallido-rufo undulatim sparsu; cristâ collique plumis anterioribus et posterioribus confertis, elongatis.*

## ORDO IV. GRALLATORES.

Fam. GRUIDÆ.

Genus *Grus*.

- 123.
- Grus Orientalis*
- , Briss.
- Ardea Antigone*
- , Linn.
- Indian Crane*
- , Lath.

Fam. ARDEIDÆ.

Genus *Mycteria*.

- 124.
- Mycteria Australis*
- .
- Ciconia Mycteria Australis*
- , Hardw.
- Tetaar Jahiru*
- , Lath.

Genus *Ardea*.

- 125.
- Ardea purpurea*
- , Linn.
- Le Héron pourpré huppé*
- , Buff.
- Crested Purple Heron*
- , Lath.

- 126.
- Ardea speciosa*
- , Horsf.
- Darter Heron*
- , Lath.

This bird is without doubt the *Darter Heron* of Dr. Latham; and the *Ardea speciosa* of Dr. Horsfield is, I think, merely the Javanese type of the same bird.

- 127.
- Ardea Torra*
- , Buch.
- Ardea Egretta*
- , Lath. Ind. Orn. var.
- Ardea alba*
- , Linn. var.
- Great Egret*
- , Lath. Indian variety
- Torra*
- or
- Bughetar*
- .

This is the Indian *White Egret*, and it differs only in size from the European species, being somewhat smaller. Dr. Buchanan named it *Ard. Torra*, and when without its filiform appendages on the back, *Ard. Putea*; so that these Indian terms appear to correspond with *Ard. Egretta* and *Ard. alba*.

- 128.
- Ardea Caboga*
- , Penn.
- Caboga Heron*
- , Penn.
- Gibraltar Heron*
- , Lath. var. A.

The term *Caboga* is a corruption of the Indian term *Gao-buga*, Cow or *Cattle Heron*, in allusion to its frequently being seen amongst cattle, like the *Gibraltar Heron*.

Genus *Botaurus*.

- 129.
- Botaurus cinnamomeus*
- .
- Ardea cinnamomea*
- , Gmel.
- Cinnamon Heron*
- , Lath.

Genus *Nycticorax*.

- 130.
- Nycticorax Europæus*
- .
- Ardea Nycticorax*
- , Linn.
- Night Heron*
- , Lath.

C. NYCTICORAX MANILLENSIS. *Nyct. supra castaneo rufa; collo in fronte, abdominis lateribus, femorum tectricibus, alarumque tectricibus inferioribus pallidioribus; capite colloque supra nigris, cristæ pennis longis pendentibus albis, apice nigro; pectore abdomine cristoque albis.*

Staturâ paulo major quàm *Nyct. Caledonica*, cui simillima; differt tamen colore cristæ, colli in fronte, tectricumque inferiorum alarum.

Genus *Tantalus*.

- 131.
- Tantalus papillosa*
- .
- Ibis papillosa*
- , Temm.
- Bald Ibis*
- , Lath.

Fam. SCOLOPACIDÆ.

Genus *Rhynchæa*.

- 132.
- Rhynchæa Orientalis*
- , Horsf.
- Cape Snipe*
- , Lath.
- Bécassine de Madagascar*
- , Buff.

RHYNCHÆA CAPENSIS, Sav. *Rhynch. remigibus angustis, fasciis latis flavis sex notatis, infra griseis, nigro-vermiculatis, stavoque fasciatis; secundariorum macula pogonii externi, fasciæque pogonii interni, flavis.*

Long. corporis 9½ unc.: tarsi, 2¼ lin.: digiti unguisque medii, 20½ lin.

RHYNCHÆA PICTA. *Rhynch. remigibus sublatissimis, externis flavo latè 7-fasciatis, infra griseo nigroque vermiculatis, interno obsolete flavo-fasciato: secundariorum apicibus, macula ultima fasciæ-formis pogonii externi, fasciæque pogonii interni, albis.*

Long. corporis 10½ unc.: tarsi, 19½ lin.: digiti medii, 19 lin.

The wing-coverts of both species are spotted with yellow in the young state; and in the adult state are metallic olive with black bands.

Genus *Tringa*.

- 133.
- Tringa ochropus*
- , Linn.
- Green Sandpiper*
- , Penn.

- 134.
- Tringa glareola*
- , Linn.
- Wood Sandpiper*
- , Penn.

- 135.
- Tringa pusilla*
- , Linn.
- Little Sandpiper*
- , Lath.

- 136.
- Tringa hypoleucos*
- , Linn.
- Common Sandpiper*
- , Lath.

## Fam. RALLIDÆ.

Genus *Parra*.

137. *Parra phœnicura*. *Gallinula phœnicura*, Lath., Ind. Orn. *Red-tailed Gallinule*, Lath. *Poule-Sultane de la Chine*, Buff.

138. *Parra Sinensis*, Gmel. *Chinese Jacana*, Lath.

139. *Parra Indica*, Lath., Ind. Orn. *Indian Jacana*, Lath.

Genus *Rallus*.

140. *Rallus niger*, Gmel. *Black Rail*, Lath.

Genus *Porphyrio*.

141. *Porphyrio hyacinthinus*. *Fulica Porphyrio*, Linn. *Purple Water-hen*, Edw.

## Fam. CHARADRIADÆ.

Genus *Vanellus*.

142. *Vanellus Goensis*. *Tringa Goensis*, Lath. *Vanneau armé de Goa*, Buff.

143. *Vanellus ventralis*. *Charadrius ventralis*, Wagl. *Spur-winged Plover*, Hardw.

144. *Vanellus bilobus*. *Charadrius bilobus*, Gmel. *Bilobate Sandpiper*, Lath.

Genus *Cursorius*.

145. *Cursorius Asiaticus*, Gmel. & Lath. *Courvite de la Côte de Coromandel*, Buff.

Genus *Himantopus*.

146. *Himantopus melanopterus*. *Charadrius Himantopus*, Linn. *L' Echasse*, Buff.

Genus *Charadrius*.

147. CHARADRIUS HIATICULOIDES. *Char. supra griseo-fuscus; fasciâ frontali alterâque verticali, corpore subtus, collarique nuchali albis; lineâ sub oculis ad aures extendente, fasciâ ad frontem, torquæque pectorali subgracili ad nucham extendente nigris; rectricibus, duabus mediis exceptis, albis, in medio nigro et griseo-brunneo notatis, fasciam semilunarem exhibentibus.*

This bird differs chiefly from the European species in size, being at least one third smaller, and in the narrowness of the pectoral band.

## ORDO V. NATATORES.

## Fam. ANATIDÆ.

Genus *Anser*.

148. *Anser Indicus*, Lath., Ind. Orn. *Barred-headed Goose*, Lath.

149. *Anser melanotos*, Gmel. *Black-backed Goose*, Lath.

150. *Anser Coromandeliana*, Gmel. *Sarcelle de la Côte de Coromandel*, Buff. *Anas Girra*, Hardw. *Girra Teal*, Lath.

Genus *Anas*.

151. *Anas arcuata*, Cuv. *Siley Teal*, Lath.

The name of this bird in India is *Siley* or *Silhei*, from its whistling note; the English call it *Whistling Teal*; it scarcely differs from the Javanese species as figured by Dr. Horsfield.

152. *Anas Crecca*, Linn. *Common Teal*, Lath.

This bird is the *common Teal* of India, and agrees exactly with the British species.

## Fam. COLYMBIDÆ.

Genus *Podiceps*.

153. *Podiceps minor*, Lath., Ind. Orn. *Little Grebe*, Lath.

## Fam. PELECANIDÆ.

Genus *Carbo*.

154. *Carbo fuscicollis*. *Phalacrocorax fuscicollis*, Shaw. *Brown-necked Shag*, Lath.

Genus *Plotus*.

155. *Plotus melanogaster*, Gmel. *Black-bellied Darter*, Lath.

Genus *Sterna*.

156. *Sterna melanogastra*, Temm. *Hirondelle de mer à ventre noir*, Temm.

### IX.—Instructions for collecting and preserving Coleopterous Insects.

Under the name of *Coleoptera* are designated all insects with hard wings, such as cockchafers, beetles of various kinds—*Curculio*, *Melolontha*, *Copris*, *Lucanus*, *Cervus*, *Scarabæus*, *Necrophagi*, &c. They are found every where on flowers and leaves, under stones, the bark of trees, moss, and fallen leaves, in rotten wood, old mushrooms, in stagnant water, and among decomposing animal and vegetable matter.

Some interesting species live about the roots of plants, which must be extracted to get at them.

Places where trees have been cut down, should be explored, especially under the logs, and, in the sun, upon the exterior of the timber.

Many insects, in hot climates, hide themselves during the day in the ground, which should be dug up round insulated trees to the depth of a few inches:—the same kind of search should be made along the foundations of walls, &c. The detritus left along the bank of a river, or the sea shore, by retiring water, should be examined. A good number of rare *Carabi* are found on the banks of ponds,—buried in the sand, or concealed under the pebbles of a dry brook. The puddles formed by heavy rain, must by no means be neglected: they abound in interesting insects.

Besides the mode pointed out above, there are various others for collecting quickly a number of insects which live upon plants: thus holding a parasol or a handkerchief under a bush or a branch, and shaking the latter affords a ready method of getting at many curious insects: or a light bag, fitted to a hoop and handle, may be moved rapidly about the extremity of branches while shaken, and the *Coleoptera* will be entangled therein and easily made prisoners.

The *Necrophagi* are not often found in hot climates, where their place is supplied by ants. The way to procure them is to place wide-mouthed bottles, baited with pieces of flesh, out of the reach of ants, that is, hung up in the air, or insulated by being placed in a vessel of water. The smell of the meat will attract the insects.

*Nocturnal Coleoptera* are very rare in collections. To take them, a cloth should be spread towards night in the neighbourhood of a flower bed, and a couple of lamps placed on it: the insects settle upon the cloth where they must be made captive without loss of time. Searching plants in the night is also very productive.

*Coleoptera* should be pinned always through the right wing, proportioning the pin to the size of the insect, and taking care not to injure the feet and antennæ.

To save time during the chase, small insects may be put in a bottle, and pinned on return. They do not injure themselves, if a little moss or paper is introduced for them to hold by. In hot climates, the best time for the chase is, the morning or the evening. Nevertheless every moment of the day abounds with new species, and a zealous collector will vary the time of his visits abroad. There is no occasion to make long walks: it is better to explore thoroughly a circumscribed space, more especially if a rare individual has been discovered, because it is probable that another may be found in the same locality: there are generally many together.

Besides the travelling box, the collector should have a number of larger boxes for the preservation of his specimens. They should be three inches deep, and the bottom covered with a stratum of cork. In intertropical countries the cork may be replaced by sola, or by various spongy woods.

One box should be devoted to large *Coleoptera*, to avoid the injury their weight would cause to the smaller species if they should get loose in travelling.

- Insects should not be put in the magazine boxes until they are dead ; they may then be put as close as possible to save space.

When the feet or antennæ prevent the specimens from being closed up, they should be placed for a time in a humid atmosphere, in a covered saucepan with a few drops of warm water, or in moistened sand :—the limbs will then become relaxed, and may be easily brought close to the body, where they must be held by pins until they have dried in the proper attitude.

For preserving *Coleoptera*, pinning is decidedly the best method, it is only large black hard insects that can be preserved in spirits : cotton, sand, sawdust, &c. are of no use whatever.

If a rare insect loses a leg or antenna, it should be carefully wrapped in paper, and pinned by the side of the mutilated animal. It is useless to collect grasshoppers, flies, spiders, or bugs. These insects are very difficult of preservation, often too very large, and therefore only encumber the boxes uselessly.

When a box is sufficiently full of *Coleoptera* firmly fixed with pins, according to the foregoing directions, it should be accurately closed by pasting paper over all the joints, so as to prevent moisture, dust, or other insects from penetrating.

The above directions are translated from a paper transmitted to the Asiatic Society by a zealous French entomologist, Mons. Petit de la Saussaye, chef du bureau des travaux au Ministère de la Marine, at Paris, who was desirous of obtaining specimens of the Coleopterous insects from India, and who handsomely offered in return, duplicates from his own extensive cabinet. The following extract from M. Petit's letter to the Secretary As. Soc. read on the 4th Jan. may tempt some of our correspondents to comply with his request.

“ Amateur zélé de l'étude de l'entomologie, je possède une des collections de Paris les plus riches en coléoptères, famille dont je m'occupe principalement.

Les relations que j'ai avec plusieurs parties de l'Afrique et de l'Amérique me donnent les moyens de faire des échanges avec les musées étrangers, et j'ai osé espérer que vous voudriez bien m'admettre au nombre des personnes qui correspondent de cette manière, avec le célèbre établissement que vous dirigez.

L'avantage que je puis vous offrir consisteroit moins dans la variété des espèces que je vous adresserai, que dans l'exactitude de la classification. Ma collection est nommée d'après le système adopté par M. le Comte Dejean, dont les ouvrages sur les coléoptères sont connus de tous les entomologistes, et les envois que je fais sont classés avec le plus grand soin, ce qui facilite beaucoup à mes correspondants l'arrangement et l'étude des insectes.

De votre côté, Monsieur, il vous seroit bien facile d'enrichir ma collection, car je n'ai presque rien des belles contrées soumises à vos explorations, et les espèces moins rares auroient déjà pour moi le mérite de la nouveauté.”

Collections or letters to M. Petit may be addressed under cover à Mr. le Ministre de la Marine, à Paris.

*Observations made at*  
**Minimum Temperature**  
*observed at surface.*

**Maximum Pressure**  
*observed at 9th. 50m.*

**Max. Temp. and Dryness**  
*observed at 2nd. 40m.*

**Minimum Pressure**  
*observed at 1st. 1m.*

**Observations made at**  
*surface.*

**Observations in Calculating**  
*at 10th. 50m. p. m.*

| Days of the Month. | Baromet.<br>reduced<br>to 32°. | Temper.<br>of the air. | Depres.<br>of M.B.Ther. | Wind. | Aspect<br>of the sky. | Barom.<br>red. to 32°. | Temper.<br>of the air. | Depres.<br>of M.B.Ther. | Wind. | Aspect<br>of the sky. | Barom.<br>red. to 32°. | Temper.<br>of the air. | Depres.<br>of M.B.Ther. | Wind. | Aspect<br>of the sky. | Barom.<br>red. to 32°. | Temper.<br>of the air. | Depres.<br>of M.B.Ther. | Wind. | Aspect<br>of the sky. | Barom.<br>red. to 32°. | Temper.<br>of the air. | Depres.<br>of M.B.Ther. | Wind. | Aspect<br>of the sky. | Rain Gauge<br>No. 1. | Rain Gauge<br>No. 2. |     |      |     |     |      |      |      |      |      |
|--------------------|--------------------------------|------------------------|-------------------------|-------|-----------------------|------------------------|------------------------|-------------------------|-------|-----------------------|------------------------|------------------------|-------------------------|-------|-----------------------|------------------------|------------------------|-------------------------|-------|-----------------------|------------------------|------------------------|-------------------------|-------|-----------------------|----------------------|----------------------|-----|------|-----|-----|------|------|------|------|------|
| 1                  | 29.352                         | 50.7                   | 1.8                     | s.    | cy.                   | 41.0                   | 50.5                   | 1.8                     | s.    | e.                    | rn.                    | 43.0                   | 53.9                    | 4.1   | s.                    | cy.                    | 36.0                   | 58.5                    | 3.3   | s.                    | cy.                    | 36.0                   | 79.7                    | 2.5   | s.                    | e.                   | rn.                  | 432 | 78.4 | 1.4 | e.  | rn.  | 0.58 | 0.40 |      |      |
| 2                  | 431                            | 78.3                   | 3.1                     | s.    | do.                   | 401                    | 80.3                   | 2.1                     | m.    | rn.                   | 408                    | 80.3                   | 2.3                     | do.   | n                     | 414                    | 84.3                   | 3.5                     | s.    | w.                    | cu.                    | 437                    | 79.7                    | 2.7   | s.                    | w.                   | cu.                  | 474 | 81.2 | 2.0 | do. | 0.55 | 0.40 |      |      |      |
| 3                  | 431                            | 79.3                   | 3.1                     | s.    | do.                   | 404                    | 81.5                   | 2.5                     | e.    | cu.                   | 408                    | 80.3                   | 2.3                     | do.   | n                     | 414                    | 84.3                   | 3.5                     | s.    | w.                    | cu.                    | 437                    | 79.7                    | 2.7   | s.                    | w.                   | cu.                  | 474 | 81.2 | 2.0 | do. | 0.55 | 0.40 |      |      |      |
| 4                  | 432                            | 76.5                   | 1.8                     | s.    | do.                   | 404                    | 77.5                   | 2.5                     | e.    | cu.                   | 408                    | 80.3                   | 2.3                     | do.   | n                     | 414                    | 84.3                   | 3.5                     | s.    | w.                    | cu.                    | 437                    | 79.7                    | 2.7   | s.                    | w.                   | cu.                  | 474 | 81.2 | 2.0 | do. | 0.55 | 0.40 |      |      |      |
| 5                  | 430                            | 81.7                   | 3.2                     | s.    | w.                    | 404                    | 80.3                   | 2.5                     | e.    | cu.                   | 408                    | 80.3                   | 2.3                     | do.   | n                     | 414                    | 84.3                   | 3.5                     | s.    | w.                    | cu.                    | 437                    | 79.7                    | 2.7   | s.                    | w.                   | cu.                  | 474 | 81.2 | 2.0 | do. | 0.55 | 0.40 |      |      |      |
| 6                  | 430                            | 81.7                   | 3.2                     | s.    | w.                    | 404                    | 80.3                   | 2.5                     | e.    | cu.                   | 408                    | 80.3                   | 2.3                     | do.   | n                     | 414                    | 84.3                   | 3.5                     | s.    | w.                    | cu.                    | 437                    | 79.7                    | 2.7   | s.                    | w.                   | cu.                  | 474 | 81.2 | 2.0 | do. | 0.55 | 0.40 |      |      |      |
| 7                  | 431                            | 82.3                   | 2.8                     | do.   | ci.                   | 371                    | 83.8                   | 3.1                     | e.    | do.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 8                  | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 9                  | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 10                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 11                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 12                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 13                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 14                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 15                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 16                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 17                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 18                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 19                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 20                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 21                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 22                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 23                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 24                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 25                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 26                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 27                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 28                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 29                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 30                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| 31                 | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |
| Mean.              | 430                            | 79.7                   | 2.3                     | do.   | rn.                   | 351                    | 84.3                   | 4.1                     | do.   | cu.                   | 434                    | 80.3                   | 2.8                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                    | 84.5                   | 3.3                     | do.   | rn.                   | 439                  | 84.5                 | 3.3 | do.  | rn. | 439 | 84.5 | 3.3  | do.  | 0.12 | 0.10 |

*Abbreviations.* In the column "wind," small letters have been used instead of capitals; *m.*, mean column; *m.*, rain; *ci.*, cirrus; *cu.*, cumulus; *cs.*, cirro-stratus; *cu.*, cumulo-stratus; *cc.*, cirro-cumulus; *n.*, number.

In the column "aspect of the sky," "cy" is cloudy; *cl.*, clear;



# JOURNAL

OF

## THE ASIATIC SOCIETY.

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No. 8.—August, 1832.

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### I.—*Progress of Indian Maritime Surveys.*

AMONGST the events of scientific interest which have recently been announced in India, is the institution in England of a new Society, having for its object the promotion of Geographical Science, and called the Royal Geographical Society. Mr. Barrow, the reputed author of many valuable articles in the *Quarterly Review*, illustrative of the Geography of various parts of the world, and the adviser of those expeditions into the Arctic Seas, from the success of which in exploring the northern coasts of the American continent, so much credit has redounded to the British nation, is the President of this Society; and certainly, since the death of our own Major Rennell, there is no one whose reputation stands so high in this department of science, or whose zeal, acuteness, and rare tact in the discrimination of the value of materials promise more for the success of an association devoted to such objects. There has been issued already one number, containing the first fruits of the Society's labours; and the interesting papers it contains, added to the style of elegance and correctness in which the maps are executed, make us wish anxiously to see the continuation.

There is no branch of science so proper as geography to be taken up by an Association of this kind, because there is none in advancing which pure study and literary research can do so little, and the progress of which depends so much upon the accidental circumstances in which men of various attainments happen to find themselves placed. For nearly all that has been done, and for most that is still doing in geography, by land or by sea, we are indebted to the exertions of practical unpretending individuals, who finding the maps and charts they are using incorrect, or lighting by chance on new objects not laid down, employ a

few leisure days in examining and noting what they thus illustrate or discover. Each in this way adds his little mite to the store of knowledge already accumulated, and, without the authentic record afforded by the published proceedings of a Society, these contributions might be withheld altogether from the world, or might fall into the hands of those who would misuse them. Henceforward the publications of this useful institution will afford a certain means of tracing discoveries to their source, and of ascertaining upon what authority additions are made in successive Maps and Charts. The compiler and publisher who has set his name ostentatiously in the corner, has too often hitherto got the credit for all the improvements introduced; while the adventurous voyager who has discovered, and the surveyor whose superior skill has delineated and assigned the true position to objects, have been defrauded of the fame which is their just due. The observation holds equally whether the addition to geographical knowledge be the result of measures taken by a Government officer, with the specific object of ascertaining or verifying a point, or of individual enterprise directed by zeal, or by accident, into this line of science. For, with exception to the large general surveys undertaken by Governments for military or for fiscal purposes, the results of which are given to the world, each with the pretension of out-doing all that has gone before, but of which the great expence must make the instances rare, the improvements effected by Government officers, are, like those by individuals, of isolated locality; and when the point has been ascertained, the result is incorporated in some general chart, and the time and manner of the survey is soon forgotten, or known only to those who from curiosity or from official duty may happen to be employed in ransacking the archives of state offices. For these reasons we look upon the establishment of a Society devoted especially to geographical science to be a most useful institution; and we hope that all who are engaged in the same pursuit, and who may become possessed of materials, or be placed in circumstances to be able to contribute any thing towards the advancement of this science, will furnish their results to the new Association, that they may be there digested and compared and verified, and so be turned to account, according to their value, in leading to a more accurate knowledge of the earth's surface—every advance made to this object being set down to the credit of the right owner.

The field of geographical inquiry is still a very wide one. The interior of many continents remains blank in our latest maps. The coasts of others are set down as handed from chart-maker to chart-maker without any recent verifications, and upon very doubtful original

authority, while of more than half the islands on the earth's surface we have no more accurate knowledge, than the fact, that they exist in clusters of uncertain number and position, and of very dangerous approach. Nay, even in the great high-ways of commerce and of navigation, there are rocks and sandbanks and other perils, as to the existence and locality of which the evidence is balanced with most perplexing equality. Such things ought not to be in this age of philosophical research, and in a department more especially which admits of exact ascertainment. We look to the labours of the new Geographical Society to dispel the mist of uncertainty which now covers so much of the earth's surface, and by little and little to bring out the whole in clear and well-defined and undisputed outlines. Those who aid in this work, may be assured of the approving cheer with which the results of their labours will be hailed by all classes and all nations ; for geography is a science, the benefit from advancing which none are so obtuse or so bigotted as not to acknowledge.

As a science, geography is entirely of modern growth. It has followed upon the advances made in the art of navigation ; and to this circumstance only can we ascribe, the comparative backwardness of the ancients in the department, and the little they have left that is of value in it. Before the discovery of the compass and the improvements made in the construction of ships, and the numberless inventions which have made navigation a means of access to the remotest corners of the far distant ocean, the geographer's materials were confined to itineraries, and the confused records of military expeditions, and of laborious land-journies. Then mountains and rivers, and interior seas, deserts and lakes, were the objects of first discovery. Now we have the coasts and outward appearance, and the entire size of a continent thoroughly ascertained and delineated before we know any thing whatsoever of the interior. With the advance of navigation came the necessity of providing the means of accurately knowing, whereabouts on the earth's surface the winds and waves had carried the adventurous voyager. Hence the discovery of instruments for determining latitudes and longitudes with a precision before unthought of, and hence the ability to assign a place on the general map of the earth's surface to every object that presented itself to the navigator's observation.

The refined and scientific surveys on land, undertaken for the correct determination of the earth's figure, would never have been set on foot but for the discoveries previously made by navigation. They are but an extension of that science, and are effected through an application of the same instruments and materials, though these are prepared and

used of course with much more elaborate care than for the common purposes of the practical voyager.

Seeing, therefore, how entirely dependent geography has been, and still is, and, for a long time to come, must be upon navigation, we learn to appreciate the labours of those marine surveyors and careful scientific navigators, through whom we have arrived at a correct knowledge of the positions of islands, and of the figure of continents, and of the bays and rivers, and rocks and sand-banks, which distinguish the shores of seas and oceans, and thus are enabled to compile a chart which shall accurately exhibit the phænomena of the earth's surface, and enable future voyagers to steer boldly to ports they have never before visited; astonishing the native inhabitants by the display of more information on the subject than they possess themselves.

There is nothing however more deceitful, or that ought to be received with more distrust than a chart or nautical survey, with the author of which and the materials of construction we are unacquainted. There is not a midshipman nor a captain's clerk in the mercantile navy that cannot take a latitude and a bearing, and with the help of the printed navigation tables, make an approximate calculation of the longitude. Nobody, therefore, that sails in a ship which happens to light upon strange lands, or upon objects of any kind not laid down in previous charts, fails to assign at once a locality to what he sees; and if the time allows him to cast anchor, a chart is constructed from a series of bearings, and produced with as much confidence as if made from the best trigonometrical data. If the author of the discovery be a man of credit and intelligence, his chart is incorporated in those published to the world, and continues, with all its defects, to be given out as the best record possessed of the portion of the earth's surface delineated. This is exactly as it should be, and no one in his senses, would wish such information and materials to be suppressed; but the difference is wide between the sketch of a casual voyager of this kind, put together from compass bearings, and logboard distances, and computed latitudes and longitudes, and the accurate delineation of the practised nautical surveyor employed to verify, and to ascertain once for all, the exact position and outline of what has been hitherto vaguely and imperfectly known and reported.

The Governments of British India are entitled to much credit, for the manner in which the means at their disposal have been employed in furthering the advance of our geographical knowledge, by surveys of this kind. The department has, in the seas to the eastward of the Indian peninsula, been for many years under the direction and personal management of Captain Ross, Senior Commander in the Indian Navy, and Marine

Surveyor General to the Supreme Government. The reputation of this officer stands already too high to be affected by any commendations we might bestow upon the works he has produced. We look upon the charts as complete models in their kind, knowing them to be constructed with a care and a regard to scientific accuracy, creditable alike to himself, and to the Government, which approving his cautious methods, leaves him to prosecute his surveys as his own good sense may suggest, unembarrassed by minute instructions, and with merely the locality and direction of his investigations indicated beforehand. The result is, that charts are annually produced, which convert tracts of complete *terra incognita*, or coasts roughly laid down from the loose bearings and observations of casual voyagers, into lines of accurately defined and well delineated shore, with the mountains and highlands, the bays and harbours, the rivers and watering places, and all the towns or villages, within observation from the sea, correctly set down. Each of these charts is a new acquisition to geography, quite independent of the service done to navigation by laying down the real position and bearings of dangers, visible or hidden; and by enabling every nautical man, on approaching the coast surveyed, to know for certain where he is, and what course he should steer in prosecution of the voyage he has in hand.

A coast once laid down by the accurate methods pursued by Captain Ross, needs never to be surveyed a second time. Future investigators may complete what from circumstances may have been left by him imperfect. They may add a few new lines of soundings, but they will find nothing to find fault with or to require correction. Indeed, the confidence with which practical navigators, when once they come upon the ground included in his surveys, follow boldly his directions, and shape their course at pleasure, in the most intricate passages, is both a compliment to his industry and professional skill, and a proof of his well-earned reputation in the department.

Captain Ross was, we believe, first employed in surveying various portions of the China Seas, under the orders of the Court of Directors, issued as far back as in the year 1806. These surveys occupied him 14 years, and embraced all the most prominent dangers of the frequented passages of navigation to and from China, and all the most important coasts of that empire. The charts were separately published, as they were completed, but the whole were afterwards incorporated in the General Chart published by the hydrographer of the Company, and which bears Mr. Horsburgh's name,

In 1823, Captain Ross was appointed by the Court of Directors to his present office of Marine Surveyor General. His operations were necessarily interrupted during the Burmese war; but the following surveys have since been executed in succession under his superintendence, and mostly by himself personally.

1. The Rangoon river to its mouth.
2. The straits, approaches, and harbour of Singapore.
3. The Mergui archipelago, Tenasserim coast, and Martaban, with the river at Amherst and Moulmein. The sheets of this Chart cover a line of coast extending from Lat.  $8^{\circ} 28' N.$  to  $16^{\circ} 32'$  and include a vast number of Islands never before laid down or even visited by Europeans.
4. In the meantime, the coast of Ava from Negrais to Ramri, and Sandowí, was surveyed by Captain Crawford, and Chedúba roads and Ramri, by Captain Ross's assistant Lieut. Lloyd.
5. The coast of Arracan, north of the point to which Captain Crawford's Chart extended, was, in the past season, the object of Captain Ross's personal survey; and, in one or two seasons more, the entire eastern shore of the Bay of Bengal will have been laid down by this officer, or by those under his orders, with as much accuracy as can be claimed for the charts of the coasts of Europe and the Mediterranean.

All Captain Ross's surveys, and those made under his orders by junior officers of the department, are laid down from bases carefully measured on shore, where this has been possible, and are strictly trigonometrical; and though necessarily wanting that minute correctness aimed at in similar surveys on land, they possess, nevertheless, an accuracy fully sufficient for the scale on which the Charts are delineated. The base lines on shore are measured on the most favorable level spots that can be found, by running a ten-foot rod along a cord, stretched tight between the extreme points, and kept in position by stakes, of which the direction is verified by a telescope at one end. Second and third bases are measured for further assurance, and in correction of the first.

If there be no means of measuring a base on shore, as when the locality of rocks and sand-banks, out of sight of land, may have to be ascertained, recourse is had to the measurement of a base by sound, which in a long line of  $5\frac{1}{2}$  to 6 geometric miles is a process affording more practical accuracy than would be supposed. The vessels being anchored at this distance, and a calm period chosen, the distance is taken between the flash and report of a gun, and upon the assumption that sound travels at the rate of 1140 feet per second, while with repeated

*Note.*—The Andaman Islands were surveyed as far back as 1789, 90, and 1793, by Captain Blair.

experiments the time can be taken to a tenth of a second, the distance of the two vessels is obtained by this process to within at least 50 or 60 yards.

• The angles subtended by the different points on shore, are taken always with the sextant, and the azimuth compass is only resorted to in order to lay down the true meridian. The practice of taking points by bearings of the compass, though common with many nautical surveyors of repute, is one that admits, comparatively with the sextant, of very little accuracy. The theodolite cannot be used on board ship.

Frequent observations for latitude and longitude, made both on shore and on ship-board, and as well from morning as from evening sights, afford further means of insuring accuracy; and it has been stated, that upon the result of the survey made of the coast and archipelago of Mergui and Tenasserim, extending through a space of eight degrees of latitude, and of one or one and a half of longitude, and comprising upwards of 600 islands entered in the chart; the difference in position of any two intermediate objects found trigonometrically, barely exceeded, when tested by careful observations for latitude, one quarter of a mile:—more than this cannot be desired for any purpose within the objects of a Marine Survey.

It has been usual for the Government, upon receiving each chart as it is completed, to strike off a few copies by lithography, and to send the originals to England, where they are engraved by the Court of Directors, and we presume, made accessible to the public. We have heard occasional complaint of difficulty in procuring copies, but whether that difficulty refers to their not being furnished from the Government offices in India, or to disappointment at not being able to procure them here to purchase, we confess that we do not thoroughly understand. The later Charts of Captain Ross, and in particular the very interesting survey of the Mergui archipelago and Tenasserim coast, are well deserving of the attention of the Geographical Society in England, from the additions they afford to the geographical information possessed of those countries; and we hope to see them noticed with due acknowledgments by that Society. Did we possess the same facility of neat engraving, that publishers in England have at command, we should have thought it our duty to annex to this article, a sketch of the whole of this coast and of its islands, as now laid down, compared with the same as given in the latest previous Charts, in order that the extent of the improvement effected might be duly appreciated. The backwardness of India in this branch of art compels us to leave this to be done by others.

The progress of the maritime surveys on the western side of the peninsula of India, has not been less effectual in defining the outline and real bearing of the coasts, and the position of the islands, rocks, and sand-banks, between the Indus and the African shore, including the two inland seas of Persia and Arabia. We have not the means of stating the periods when each tract of this wide space was surveyed, or of giving the names of the officers employed upon the work; but we learn that a series of engraved charts, illustrative of a considerable part of the shore of Persia, has been lately received from the Court of Directors in England, and we know that a surveying establishment is maintained for those seas, quite independently of that under the Supreme Government at the head of which Capt. Ross is now placed.

That establishment, we may be assured, has not been idle, but it is the less necessary for us to enquire what may have been the result of its official labours, because we learn that a branch of the Royal Geographical Society has already been formed at Bombay, so that we may look forward to receive accurate reports of the progress making there in every branch of this science, either in separate publications for embodying the proceedings of the Branch Society, or in the communications and papers it will contribute to the pages of the parent Society in England.

The example of this diligence, ought not to be lost upon us; and although the proceedings of our Asiatic Society, and several articles which this publication, or its predecessor, has been the means of laying before the world, sufficiently shew, that the interest and curiosity already directed to this field of science needs little further stimulus or excitement, yet we confess, that we think it might be advisable for the Asiatic Society to form a separate committee of its members into a Geographical Class, whose labours should be specially directed into this channel, as is the case with the Physical Class already formed, and through whom correspondence might be opened with the Royal Geographical Society in England, and with the Branch Society more recently established at Bombay. This object is well worthy of the attention of those members of the Society who have devoted themselves to Geography, and who as navigators, travellers, and professional surveyors, may have already contributed, or may have the means of contributing to the stock of information already accumulated in this line. Their experience and talents cannot be more usefully employed than in comparing, combining, and publishing in a mature and digested form the materials which, if such a Committee of the Asiatic Society were in existence, would, there can be no doubt, be offered in abundance from many quarters.



## II.—On the Mammalia of Nepal.—By B. H. Hodgson, Esq. C. S.

[Read in the Physical Class, 8th February.]

The geographical distribution of animals is, I observe, daily attracting, more and more, the attention of the ablest Zoologists; and reasonably, for this view of the subject has many relations of great interest and importance. On this account I am induced to offer to the Society, a summary enumeration of the Mammalia of Nepal. But as the territories comprehended within the dominions of the Gorkhali dynasty, and now universally denominated Nepal, possess an extraordinary variety of temperature and physiognomy, it will be necessary to preface my account of the animals found within its limits, by a brief description of the climate and physical aspect of the materially different parts of these territories. These parts are three, the juxta-Indian, the Central, and the juxta-Himalayan. The first embraces the Tarāi or marshes, the Bhāwar or forest, and the little hills with their subject valleys up to the base of the mountains, properly so called.

The marshes and forest are on the level of the plains of Hindūstan, and possess their climate, with some increase of heat from deficient ventilation, especially in the forest; and with an excess of moisture, derived from numberless petty streams oozing out of the hills, and dissipating their waters in the soil of the forest and Tarāi, for want of force to cut channels for themselves into the rivers.

About  $\frac{1}{10}$  of the Tarāi is cultivated: the rest is overrun with topes gone to jungle, brush-wood, and giant-grass. Large tracts of the grass land of the Tarāi are annually subdued by fire, and afterwards depastured by thousands of cows and buffaloes, but only for about two months; after which the grass growing out of all compass, restores to these temporary pastures, the features of the surrounding wilderness.

The forest is entirely void of cultivation, and is a prodigious assemblage of noble trees woven together by immense creepers; and incumbered, above, with air plants; below, with underwood and grass from 6 to 10 feet high.

The *third* portion of this tract, comprising the small hills with their subjacent valleys, up to the base of the great or true mountains, has the same character with the forest, (save where, here and there, one of the valleys has been cleared and worked,) and the elevation of this tract is too inconsiderable to make any difference in its temperature.

The malaria prevails equally and terribly throughout all three parts of this region, from the middle of March to the middle of October; and whoever has traversed it must, I think, *feel* that the pestilence is

generated by the undue and almost exclusive prevalence of vegetable exhalations in the atmosphere. There is no free ventilation; and the forest and the lesser hills (where the malaria is worst) are absolute wildernesses of rank vegetation, of so extravagantly rife an increase that in Oriental phrase, you may almost *see and hear it grow!*

Yet, it is worthy of remark, that in this pest-house, from which all mankind flee, during 8 months of every 12, constantly reside and are bred\* some of the mightiest quadrupeds in the world. The royal tiger, the panther, the leopard, the elephant, the *arna* or wild buffalo, the rhinoceros, and stags of the noblest growth, abound: and, what to our fancies is less singular, the same malarious region cherishes Boa constrictors of the largest size, and other huge creatures of their kind.

The like is notoriously the case elsewhere: yet still we may reasonably insist on the fact, and ask what is it in the constitution of these large quadrupeds, (I omit the serpents in the argument,) carnivorous and herbivorous, which enables them to breathe healthfully the air that is death to man. Take *tame* animals of their very kinds suddenly into this region between April and October, and, like man, almost, they will catch the malaria and die. On the other hand, there are particular tribes of men bred in these or similar places, (such as the Thârû of the spot and the Dhângar of South Belâr,) who can *live* there, at least, if not flourish. They die not; neither do they pine visibly;

\* A friend, who is looking over my shoulder as I write, suggests to me, that Bishop Heber has observed in his Journal, that the malarious tract is entirely abandoned by wild animals, as well as by man and his flocks and herds, in the unhealthy season.

The Bishop probably was unaware that the malaria is not confined to the Tarâi, properly so called, but rages throughout the saul forest and the lesser hills, up to an elevation of some 3000 feet on the mountains: and that the wild animals, which are driven, by fire, out of the more open parts of the Tarâi at the close of the cold weather, and cannot return till the rains have restored to them the shelter of a rank vegetation, retire during this interval to the covert of the forest and lesser hills.

If the elephants, rhinoceroses, wild buffaloes, and tigers, were to quit the malarious tract *altogether*, they must either ascend the huge mountains of the central region of Nepal, or, issue out into the plains of Hindûstan: either of which suppositions is extravagant enough, one would think, to refute itself, were they not both of them, as they are unquestionably, refuted by notorious facts—such as the extraordinary depredations committed upon the crops of the Tarâi by wild elephants and buffaloes issuing out of the forest at the height of the malarious season—the circumstance of European gentlemen seeking the tiger in his lair, on the confines of the forest, in March and April, at the hazard of their lives, because he is to be found *no where else*, &c. &c.

but they are poor specimens of humanity ; whereas the great quadrupeds alluded to are the largest and most vigorous of their respective kinds.

These facts would seem to indicate, that the principle sought is that of inherited habits of body, or acclimatization, carried to such perfection by course of time, in respect to the great quadrupeds, as to have superseded their original and natural habits of body—carried to a much less perfect state in regard to the particular tribes of human beings in question. The elephant, tiger, &c. may well be supposed to have tenanted these recesses for countless ages—man has but recently attempted to divide the dominion with them. Yet, it must be confessed, that the notions broached carry the idea of physical adaptability to an extreme extent ; besides contradicting the accepted opinion as to the superior capacity of man over the brutes in that respect. Let it be observed, that in these observations I wish merely to insist upon the singular fact, which I do not remember to have seen noted elsewhere, viz. that in the most noxious tracts of country, tracts in which man cannot live, some of the noblest quadrupeds abound and flourish—quadrupeds whose superior organization precludes the idea that the principle of life is differently modified in them and in man, and which consequently ought to be similarly affected with man by atmospherical causes. Why then, are they not so ? Craving pardon for this digression, I now proceed briefly to characterise the region which I have denominated the central one.

This consists of a clusterous succession of mountains, varying in height from 3 to 10,000 feet, covered every where with a deep bed of mould, which feeds and sustains the most superb trees, and shrub vegetation, and grasses, in general, too rankly luxuriant to afford wholesome pasture.

The mountains are very precipitous, with extremely narrow intervals. There are no extensive high flats, such as we call table lands or plateaux, and only two low flats or valleys of any extent, which are those of Nepal proper and of Yûmila. The succession of the seasons is the same as in the first region, and in the plains of India ; from which the central tract differs only in the material respect of temperature. Varying with the diversities of elevation, this region possesses a temperature from 10 to 20 degrees lower than that of Hindûstan, and, with some allowance, its climate may be characterised as similar to that of the Mediterranean shores. It is as moist as the plains of North Behâr, and, upon the whole, as salubrious as most countries in the world. Not a  $\frac{1}{50}$ th part of its surface, probably, is under the plough. For some unexplained reason (I myself suppose the rankness of the pas-

ture) neither the small nor large horned cattle flourish in it, in the domestic state: and the paucity of its wild mammalia would seem to indicate that animals of this class find its climate inimical to them even in the state of nature.

The third region of Nepal is the juxta-Himalayan, called by Buchanan the Alpine, and by the natives denominated the Kachár. From the crest or spine of the Hemáchal it extends, in breadth, about 10 horizontal miles. The mountains are of a like structure, and as splendidly wooded almost as those of the central region, but much higher, being, I should suppose, generally from 10 to 16,000 feet above the sea, up to the limit of habitability; where, of course, I stop. For half the year the summits of these mountains are buried under snow; and, *near* to the Æmadus, their sides and basal intervals also. The suite of the seasons is tropical, as before; and, occasionally, the heat is extreme. But the season of heat is short; and, upon the whole, the climate of this region more nearly resembles that of high than that of low latitudes. It has nothing tropical about it but the course of the seasons. Its grasses are short and wholesome: its underwood free from rankness; and hence probably its cows, sheep, and goats, are numerous, large, and fine; whereas, as already observed, they are few and poor in the proximate region, the succulent vegetation of which retains much of the tropical extravagance of growth. When the heats set in, in the central region, all the woollen-wearing inhabitants of the Kachár hie away to their own province; nor ever return till the approach of the cold weather. *Ex uno disce omnes*. It is the same with the birds as with the mammalia. There are peculiar ones to each of the three regions—a point which I insist on, because, those very persons who are so careful in mentioning the habitat of animals have described many procured from the kingdom of Nepal, without advertence to the particular part of that kingdom whence they were obtained.

I now proceed to my enumeration of the mammalia of Nepal, distinguishing such as belong to the lesser hills, forest, and Taráí, such as are found in the central region, and such as are peculiar to the Kachár. Let me begin by acknowledging that I am but an amateur zoologist, and have but recently turned my attention to the mammalia: but as I may be soon removed from Nepal, or may have my attention drawn off from Natural History to graver labours, I shall not let an idle conceit of accuracy prevent me from mentioning what has fallen under my observation, so far. My personal knowledge of these hills is chiefly confined to the central and northern

regions above defined; and of the mammalia of the lower or juxta-Indian region, I have probably less knowledge than was possessed by Abel, Duvaucel, and others, now alas! no more; but whose investigations have, no doubt, survived them. Without professing therefore to give a full or exact enumeration of the mammalia of Nepal, I proceed to notice the result of limited observation. Should I remain here, and have leisure, I can and will follow up the subject.

#### CLASS MAMMALIA.

SUB-CLASS UNGUICULATA. *Family Bimana. Genus Homo.*

The great indigenal mass of the population of Nepal belongs to the Kalmak division of the vast mongolian variety of the human race. But the dominant tribe of Khas are mongrels; derived, on the male side, from the Brahmans and Kshetriyas of India, on the female, from the Aborigines, and chiefly from the Magar and Jária clans of these.

These observations apply to the northern and central divisions of the country. The southern or juxta-Indian division is peopled, so far as it is peopled at all, either by the Hindús and Músulmans of the plains, or, by a peculiar race demominated Thârú, of probably similar origin with the Bhíls, Coles, and other rude mountaineers of the great Indian continent. The Thârú, however, though their language and physiognomy prove them to be a distinct race from the Hindús, have probably been much mixed with the latter; and, at all events, are fairer, less ugly, and less barbarous, than the Indian mountaineers in question.

#### *Family QUADRUMANA.*

There are no monkeys in the northern and central\* regions; and those of the southern region are identical, so far as I know, with the ordinary species of the plains, viz. the *langúr* and the *bândar*. There are no others that I am aware of.

I am not acquainted with any animal of the genus *Lemur* in Nepal; but the, for the most part, nocturnal habits of these animals tend to withdraw them from observation. It is probable, that the slow-paced *Loris*, at least, inhabits the lower hills; and possible, that species of other sub-genera are tenants of that immense solitude.

\* Religion has introduced the Bândar into the central region, where it seems to flourish, half domesticated, in the neighbourhood of temples, in the populous valley of Nepal proper. My shooters were once alarmed in the Kachár by the apparition of a "wild man," possibly an ourang, but I doubt their accuracy. They mistook the creature for a cãcodemon or rakshas, and fled from it instead of shooting it. It moved, they said, erectly: was covered with long dark hair, and had no tail.

## Family CHEIROPTERA.

The genera *Galeopithecus* and *Phyllostoma* are, I believe, wanting. Of the four remaining genera of this family, viz. *Noctilio*, *Vesperugo*, *Pteropus*, *Rhinolphus*, there are abundance in the Tarāi: but few in the central region, and fewer still in the northern. One species of *Rhinolphus* harbours in out-houses in the central regions, and occasionally enters dwelling houses at night when attracted by the lights. And one species of *Pteropus* appears in the autumn, and then only, to plunder the ripe pears in gardens. It is similar in characters with the great "fox bat" of the plains; but much smaller, and of a duller colour, or uniform dusky brown.

## Family PLANTIGRADA.

There are no hedgehogs in Nepal. Moles are found only in the Kachár. Musk shrews abound in the lower and central regions, wherever there are human habitations. The shrew of Nepal is a smaller variety of the familiar stinking creature called ordinarily the musk-rat in the plains. It is the *Sorex Indicus*. No such animal is known to the Kachár. Bears (*Ursidæ*) of different kinds abound in all parts of Nepal, and are very dangerous and troublesome:—in the Tarāi, *Prochilus Labiatus* and *Helarctos Malayanus*;—in the central and northern regions, *Ursus Isabellinus* and *Ursus Tibetanus*. And here we may notice those interesting animals of newly proposed subgenera, which serve to connect the bears with the civets and weasels. *Ailurus Fulgens* and *Ictides Albifrons* belong to the Kachár, though they are occasionally found in the central region also. This latter division is the exclusive habitat of a new species of *Paradoxurus*, coloured, especially in youth, like the *Mustela Hardwickii*. It is not fœtid, and prefers, in confinement, vegetable to animal food. When very young its tail is not convolute.

## Family DIGITIGRADA.

Of the genus *Viverra*, or Civet, the *Zibet*, or Indian Civet, is common in the central region: but not known to the northern. It is probably found likewise in the lesser hills; but I am not aware of the fact. We have also, in the central region, a very small variety of the Indian ichneumon or *V. Mungos* of Gmelin.

The Tarāi, Bháwar and lesser hills teem with all the known, large Indian species of *Felis*, such as the royal tiger, the panther, the leopard, the *cheeta* or hunting leopard, besides some described and undescribed species of smaller cats. To the central region the tiger is almost unknown, and so is the panther. But leopards abound in it; they however confine themselves almost entirely to the woods, sel-

dom approaching inhabited places, or doing greater mischief than the occasional destruction of a village dog. They are much less dreaded than the bears.

Some of the small cats of the central region are numerous and beautiful; such as the *Felis Nipalensis*. The Múrmī cat (mihi) is peculiar to this tract, in which and in the northern region also is found a species of wild cat belonging to the section of the lynxes, or medial cats, with shortish tails and pencilled ears. It answers precisely to *Felis Chaus* of Ruphel, but not to the booted lynx, which has usually been held to be the same animal. The domestic cat is as common in Nepal as elsewhere, and has no peculiarity worthy of note. Judging by its marks, I should conjecture that it is derived from the *Felis Nipalensis*; if so, it has lost by domestication the fine ground colour of that beautiful species. Strange as it may appear, it is unquestionably true that the royal tiger is found in the Kachár, close to the snows. But it must be remembered, that in that extraordinary region there are valleys of extreme depth and heat, as well as mountains of extreme height and coldness. Why this monster should avoid the central region, and yet seek the western one, may be probably explained by the paucity of ruminants in the former region, and by their comparative abundance in the latter: and it must be remembered, that there is free access from the Tarāi and Bhāwar (the nursery of tigers) to the Kachár, by the means of the banks of the large rivers. The leopard is also found in the Kachár, and a variety of undescribed small cats. All the three regions of Nepal abound in weasels (*Mustelidæ*), many of which are unknown altogether to Natural History.

We have, in the central region, besides *Mustela Hardwickii*, another species nearly allied to it, but of a fuller habit, and larger: and yet another similarly allied, but very small and beautifully coloured. The two last are undescribed. In the lower hills is found a new species, with shorter tail than the above, and more closely resembling the vulgar weasel of England: having a white stripe down the vertex and a white band across the forehead; and one species in the Kachár, also new. The polecat likewise is an inhabitant of the central and northern regions,—rare in the former, and common in the latter.

Of the genus *Lutra*, we have seven species, all differing from either of the two species found ordinarily in the plains, as well as with one exception, from those described by authors. The exception alluded to is the common otter, (*L. vulgaris*), of which the largest Nepalese species cannot be considered more than a variety. This animal

in Nepal reaches the length of five feet, inclusive of the tail ; and is upon the whole, the largest, though not the longest, species we have. It is peculiar to the lower region, where, also, three other species have their habitat. Two more belong to the central region : and one only to the Kachár. One species is yellowish white all over : the rest are brown, more or less dark ; some having the chin and throat, or whole inferior surface, paled nearly to white. They differ in extent from 5 feet to  $1\frac{1}{2}$  foot ; and not much less considerably in bulk, for some of them exhibit an almost vermiform habit of body ; and others are as stoutly made as the badger.

#### *Genus Canis.*

The only domesticated species of dog found in any part of Nepal south of the Kachár is the common village dog, or *chien de rue* of the plains, usually known there by the name of the pariar, a prick-eared cur belonging to every body and nobody. The Parbattiahs however prize the creature, and render it useful in hunting deer and antelopes. It belongs to Cuvier's 2nd section.

The noble beast usually denominated the Nepal dog is found only in the Kachár, where alone in Nepal he can live. It was introduced into the Kachár from Tibet, in which region it is indigenous, and in various parts of which there are several varieties. That of Lassa is the finest, and is almost always black, with tan legs, and a false or 5th digit before and behind.

Landseer has excellently figured a male and female of this dog, which were taken from the residency and presented to the king of England. The *mustang* variety is rather smaller, of a bright red colour, with wall eyes ; and he wants the 5th digit behind. Even in the Kachár, this dog degenerates rapidly ; and he can no more bear the heats of the central region of Nepal than his country-fellows of the human race. This would seem to be the dog whose extraordinary powers, ages ago, surprised Alexander and his Grecians. It is found throughout Tibet. This dog is justly placed in Cuvier's 3rd section of the *caninæ* ; but he ought surely to be classed under the variety mastiff, not bull dog. His superior size, moderately truncated muzzle, long fur, sunken eye, perfectly pendant ears, and 5th claw on the hind foot (in the Lhassan animal at least) seem decisive of this point. The chief character of the skull consists in the great development of the longitudinal and transverse cristæ. There is a species of wild dog\* peculiar to each of the three regions of Nepal. That of the lower region is the smallest and darkest : that of the central tract is of a

\* *Canis primævus*, mhl. The *Búdnú* of the Nepalese.



deep ferrugineous red ; and that of the Kachár of a wolf-like reddish sandy yellow, as much larger than the wild dog of the central region, as that is larger than the species or variety belonging to the lesser hills and forest.

• These dogs are very numerous, but so exceedingly shy of human habitations, that it is only by rustication in the depths of the woods of Nepal that you have a chance of seeing or even hearing them. Through the kindness of the first minister of this state, I have obtained, alive, several individuals of them, especially of the variety peculiar to the central region, and have kept them in confinement for many months.

They are all alike distinguished by a double, thick coat ; large, erect, wide, coarse, obtusely-pointed, ears ; feet with hairy soles ; a straight, very bushy tail, of medial length ; and jackal-like odour, form, proportions, and aspect. And, if I may trust 5 skulls, of mature or old individuals, now in my possession, their dental system contradistinguishes them from all their congeners : for they have only six molars on either side of either jaw. The swell of the parietal portion of the skull is very great ; and, as these primitive dogs have only a moderately elongated head, they must be arranged under Cuvier's second section of the *Caniæ*.

The jackal of the plains\* is very abundant in the lower and central regions of Nepal, rare in the Kachár. In the Taráï, the small Indian insectivorous fox\* is found ; but not in the forest of lower hills ; nor in the central mountains, nor in those of the northern region. Six years ago, I introduced it from below into the valley of Nepal ; and it seems to thrive well. The Kachár has a large peculiar species of fox, which I have not been so fortunate as to see. The wolf of the plains is unknown beyond the limits of the level country, nor is there any other species or variety peculiar to Nepal ; unless it be found in the Kachár : which I am not aware of. The like is true of the hyæna.

#### *Family PEDIMANA.*

This family presents, as far as I know, a perfect blank.

#### *Family RODENTIA.*

The common species of the genus *Hystrix* is frequent in the central and lower regions ; unknown to the Kachár, I believe. In the Taráï,

\* We want descriptions of both of these, which differ as varieties, from all those described.

the ordinary small species of hare\* of the plains abounds: and thence extends into the central division, where, however, it is very scarce.

There is a larger species very nearly resembling the English, in the central and northern regions; but rare in both. The genera *Kangarus*, *Castor*, and *Cavia*, are unknown to us. In the southern region the common, little, striped, squirrel of the plains abounds. In the central region we have an animal of the same size and characters, but of an unstriped earthy-brown colour, tipped with golden yellow: and in both these tracts the beautiful flying squirrel is found—a large species, rich deep red-brown above, and golden yellow below; belonging to the sub-genus or subdivision *Sciuropterus* of the younger Cuvier. It is not known to the Kachár, but is most common in the central region.

Of the genus *Mus* we have none of the numerous sub-genera except *Mus* proper and *Arctomys*; the latter, confined to the Kachár. The rat of Nepal is a small variety of the common type (Norway rat), and is very numerous and troublesome. The *Mus giganteus*, or bandicoot of the plains, is unknown to it. House mice are rare, and no way peculiar: field mice, common. I have already noticed, in its proper place, the musk-rat, or, more properly, musk-shrew.

#### Family EDENTATA.

Genus *Manis*. The short-tailed species of *manis* is of frequent occurrence in the hills of the lower region, and in the mountains of the central tract. It is unknown, I believe, to the Kachár. The received opinion, that it has no external ears, is a mistake. I am not aware that any of the other genera of this family are found in any part of Nepal.

#### Family TARDIGRADA.

The solitary genus of this family† (*Bradylops*) is not, so far as I know, known to Nepal.

#### SUB-CLASS UNGULATA. Family PACHYDERMATA.

The elephant and rhinoceros abound in the forest and hills of the lower region of Nepal, where they breed, and have their fixed abode; and whence, in the season of the rains, they constantly issue

\* Like the Indian fox and jackal, it still remains to be accurately described and distinguished.

† N. B. Arrangement is no part of my object; and, in want of books, I follow the tabular synopsis of the Mammalia given in the GLEANINGS IN SCIENCE, No. 29. It is sufficiently near to the most accredited and notorious system to be generally intelligible, in the way in which it is used by me.

into the cultivated parts of the Tarāi to feed upon the rice crops. Both these genera are entirely unknown to the central and northern regions. The elephant is that so well known as the Indian variety, and as such is contra-distinguished from the African variety. But it may be questioned, if there be not two distinct varieties or species in India alone, viz. the Ceylonese, and that of the saul forest. The former differs materially from the latter by having a smaller lighter head, which is carried more elevated, and by higher forequarters. It is also said to be larger, and of a more generous and bold temper. The difference of size, however, is certainly a mistake. I cannot speak to the point of temper. The rhinoceros is of the unicorn species. The two-horned is unknown.

The rhinoceros (as I had the good fortune, eight years ago, to have an opportunity of ascertaining in the menagerie of the Rajah of Nepal) goes with young from 17 to 18 months, and produces only one at a birth. When born, and for a month afterwards, the young has a pink suffusion over the dark colour proper to the mature hide. At birth, it walks pretty firmly, and measures three feet four inches long (exclusive of tail), and two feet high at the shoulder. At a month old, it is very active and vigorous, and measures 3 ft. 10 in. by 2 ft. 5 in. I have just seen and carefully examined this young animal. He is now eight years and a month old, but is certainly very far from being adult. His length (without the tail) is 9 ft. 3 in.—his height, at the shoulder, 4 ft. 10 in. utmost girth of the body 10 ft. 5 in. length of the head 2 ft. 4 in. and of the horn 5 inches.

The rhinoceros continues to suck its mother for nearly two years, and is believed to live at least 100 years; having been in one instance, taken mature and kept at Kathmandu 35 years, without exhibiting any symptoms of approaching decline. If reared in confinement, or taken young, the rhinoceros is perfectly tractable, and may be driven out to graze, through the streets of a crowded city, by a single man without even a halter to restrain it.

Of the remaining genera of the *Pachydermata*, we have only the wild hog, which is common to all the three regions of Nepal, and is plentiful in all. It resembles that variety found in the plains of India, which is or ought to be distinguished by small tusks and a nearly horizontal back, the other Indian variety being conspicuous for the elevation and weight of its forequarters, and the superior development of its canine teeth or tusks.

## Family RUMINANTIA.

The great forest of Nepal is the nursing mother of numberless animals of the genus *Cervus*, which, in the rainy and cold months, when cover abounds, thence issue into the Tarāi; and in the hot months, when fire is effectually employed to clear the Tarāi, and forest too in a less degree, of grass and underwood, retreat into the recesses of the lower hills.

Besides the Chittra, the Lagna or Páda, and the Súgoriah of the plains of Hindústan, (the spotted *Axis*, the spotted and the brown Porcine *Axis*, respectively,) to the lower region of Nepal belong, the Bárah Sinha, a splendid variety of the common stag or *Cervus Elephus*; three species of the *Rusa* group of Major Smith, denominated collectively Jarāi by the Nepalese, and contradistinguished by the epithets Phûsro, Râto, and Kâlo, or hoary, red, and black; of which the first is the *Cervus Hippelaphus* of Cuvier; the second, possibly, Major Smith's *C. Equinus*; and the last, undescribed, the Bahraiya, a new osculant species, serving with *C. Wallichii*, to connect the Elaphine and Rusan groups of Smith; and, lastly, a new species of Muntjac described by me under the local name of Ratwa.

There is no deer proper to the central region but the Ratwa, which, though it occur in the hills of the southern division, and in the lowest valleys of the Kachár, is the more peculiar inhabitant of the middle tract. I can make nothing of Sir W. Ouseley's musk deer of Nepal, referred by Smith to the Muntjacs, and named *C. Moschatus*.

The Râto Jarāi is sometimes found in the mountains; but it, and the other two species of Jarāi, belong decidedly to the lower region.

In the Kachár there is no species of *Cervus*; the Nepal deer or *C. Wallichii* being, I am pretty sure, trans-Himalayan; and the Ratwa being, as already hinted, a vagrant there.

Of Antelopes, the Ghoral (*A. Ghoral*, Hardwicke) belongs exclusively to the northern and central divisions; the Thár (*A. Thár*, mihi) properly to the central, though he occurs also in the northern and southern regions; and the four-horned and black antelopes, (*A. Chikara* and *A. Cervicapra*,) exclusively to the lower region. The former keeps to the open plains of the Tarāi; the latter, to the cover of the saul forest. And there are no more antelopes in Nepal; for the Chirú (*A. Hodgsonii*, Abel,) never passes the Himalaya, nor even approaches that stupendous chain of mountains; it being confined to the open plains of north-eastern Tibet. The Thár, much more

properly than the Ghoral\*, belongs to Major Smith's *Næmorrhædine* group, and bears an extreme resemblance to the Cambing Ootan of Sumatra. The females of the Thár species, however, have four teats, and carry horns. Wherefore, those indicative characters of the group, set down with a note of interrogation by its author (viz. females hornless and with two mammæ), would seem to be incorrect. In the Thár the bony core of the horns is cellular, and connected with the frontal sinuses; and the horns arise very decidedly behind the orbits; material deviations from *Antelope*, and approximations to *Capra*, agreeing with the generally Caprine character of the external attributes of this species, which is indeed linked to the antelopine genus only by its horns and suborbital sinuses. In respect to that beautiful little animal of the *Tetracerine* group, called Chouka in Nepal, Chikara in the plains, I am enabled, by means of a beautiful specimen, to say that the distinction of species attempted to be established upon the Duvaucellian and Hardwickian specimens and drawings cannot be maintained.

To the northern division are exclusively confined the wild goats and wild sheep of Nepal; of the former of which genera there is one species only, viz. the Jhâral (*Capra Jharal*, mihi), and of the latter, two species, viz. the Bhâral and the Nayaaur, or, *Ovis Argali*, Pallas, and *Ovis Nayaaur*, mihi. The latter, however, is probably only a variety of the former. The common domestic goat of the Kachâr, called by the Parbattiahs, Sinâl, is a tall largish species, with ordinary horns; long, flowing, straight hair, drooping, longish ears, and semi-erect, short tail. A small variety of the Chângra, or shawl goat, is not uncommon in the same quarter. Neither of these can endure the heat of the central, and far less of the southern region, except in the cold season.

These latter regions have no domestic breed of goats in any respect peculiar to them. The species found in them is the common little goat of the lower provinces of the Bengal presidency. It is rare and thrives not; though it does better than the goat of the upper provinces; which can scarcely be bred as a luxury or curiosity by the rich.

The domesticated sheep of the Kachâr or Baruâl, is a stout, middle-sized, short and narrow-tailed species, with chaffron extremely arched, massive horns, retaining the primitive character of the wild

\* M. P. Cuvier is mistaken in supposing the Ghoral to have suborbital sinuses. It has none. The ears are striated.

race, and very short, semi-truncated ears, depressed by the incumbency of the horns.

The rams are celebrated for their courage and pugnacity. The wool is good, but far inferior to that of the Hùniah or Bhoteah sheep, which, though naturalized in the Kachár, is of trans-Himálayan origin, and still scarce as compared with the Baruál, immense flocks of which native species are reared in the Kachár.

The Hùniah is a large, tall breed, with slender, compressed, spirally-twisted, horns, and short narrow tail. The colour is almost invariably white. Individuals of this species are apt to have 3, 4, and even 5 horns. The Hùniah cannot bear the heats of Nepal, south of the northern division, and will doubtless flourish in England, where the experiment is making of naturalizing it. Its wool is superb\*. The tame sheep of the central region, or Kágo, as it is named by the Parbattiahs, is a small breed, bearing all the characters of the Baruál; from which variety it evidently sprung at no very remote period: horns and tail, as in the Baruál: ears longer, pointed, directed forwards and downwards: chaffron less arched: fleece finer, shorter, spirally curled, almost always white.

The lower hills have no peculiar breed of sheep. Goats and sheep, rare in the central, are almost unknown in the southern hills: but both, and especially the latter, are very numerous in the northern division.

The domesticated cows of the Kachár are large and variously colored like those of England: the cows of the central region small, and black or red, like those of the Highlands of Scotland. But in the second, the hump is conspicuous; and not absent in the first. The *Bos grunniens* or Yak of Tibet likewise flourishes in the Kachár: but not south of it. It is a mere foolish error to suppose the milk of the Yak not good.

There are no wild animals of the Bovine kind in any part of Nepal, save the southern, where, as far as I know, the wild buffalo alone represents the genus—the Gayál or wild Bull of the Indian mountains being unknown to us.

#### *Family SOLIPEDA.*

Wild animals of this family are utterly unknown to Nepal; and in the domesticated state we have only some small varieties of the Tibetan pony, called here Tánghan: and though coarser and heavier, somewhat

\* N. B. Should this paper meet the eye of any wealthy and spirited individual in England, who may be disposed to forward the experiment in question, I beg to say, I shall be happy to assist him. Let him refer to Messrs. Mackintosh and Co. Calcutta.

resembling in size and character the Shetland pony. This breed is found from the confines of China to the Bilú Tag : on the western side of which range of mountains it increases in size, and becomes the Chougosha horse of the Turks. The Tánghan is bred exclusively in the Kachár division of Nepal : and but very rarely.

We have no tame asses or mules ; man being, in Nepal, the sole “ beast of burthen ;” by reason of the steepness of the mountains, and the want of made roads.

### III.—Memoir of Giuseppe d'Amato.

[Extract of a private letter from Major H. Burney, Resident at the Burmese Court, dated Ava, 9th April, 1832.]

I grieve to tell you, that the good Italian priest died last week at Moun-lha, one of the small Catholic villages up the Moo river, near Dibayen, and about 30 miles to the north-west of this city. It is a pity that some account of the life of this humble missionary cannot be communicated to the civilized world. He was a native of Naples, and his name was Giuseppe d'Amato, although he was better known to his Catholic flock, who understand only Burmese and the native dialect of Portuguese, by the style and title of Padre Don José. He and another priest, Luiz de Grondona, or as he was styled Don Louis, were deputed from Rome by the Society *De Propagandâ Fide*, at the peace of Versailles in 1783. They went to England for a passage to this country, where they arrived sometime in 1784. Soon after, the wars of the French revolution put a stop to all communication between them and Europe, and for upwards of 30 years they received no assistance whatever from their Parent Society, and were obliged to trust to their own exertions and to the charity of their followers, who are most of them in a state of poverty themselves, for the means of subsistence. They were both skilled in medicine and surgery, but particularly Don Louis, of whom very honorable mention is made by Colonel Symes in his second mission in 1803, and by Captain Canning, on several occasions. Don Louis died in this city about nine years ago.

Don José usually resided in the midst of his flock, which occupy five small villages, distant from each other from four to 10 miles, and situate in the district of Dibayen to the north-west of this city. The names of these villages and number of houses in each are stated to be as follows :

|                       |            |
|-----------------------|------------|
| Moun-lha, .....       | 25 houses. |
| Khyoung-Yo, .....     | 15         |
| Khyan-ta-roowa, ..... | 100        |
| Khyoung-oo, .....     | 15         |
| Nga-bek, .....        | 20         |

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Total 175 houses,

which are said to contain a population of about 960 souls. Most of them at one time professed the Catholic religion, but of late years many have apostatised, as D'Amato complained to me.

Besides the above-mentioned villages, there is a small one containing about 40 or 50 souls, called Mengalágoure, situate close to the western walls of this city, near the British residency. To this village, in the centre of which are a Chapel and Parsonage, built of bambús and leaves, Don José paid an annual visit about Christmas, and it was here that I first saw him in December, 1830.

He was then about 73 years of age, and I was particularly struck at observing how lively all his recollections of his native land still were. He described Naples and a celebrated piece of sculpture there, with a degree of gesture and youthful animation that quite surprised me. "Dear Italy," was always a favorite theme with him; when he first heard Mrs. ——— play on the piano forte, he burst into tears, and he wept like a child for half an hour, begging all the time that the music should not cease.

He shunned the court, and never went near any of the great men here, if he could avoid it. He lived always among his flock like one of themselves, and was venerated by them in no common degree. His dress consisted of a pair of trowsers with a black cotton gown, and Burmese sandals on his feet. He said he found stockings very uncomfortable, and could not wear them even during the cold season. His amusements consisted in drawing and painting, gardening, and when he was in the country, in driving about in a Burmese cart drawn by oxen. He said, that he had never been sick for even a day until the year I first saw him, when his constitution was evidently breaking. But even then, he walked about a good deal, and made no use of spectacles.

The district of Dibayen, in which he lived, was at one time much infested with banditti, and Bundoolah has the credit of having put them down, and settled that part of the country just before the late war. D'Amato's knowledge of medicine enabled him to do a great deal of good among the population in his district; and although the



village in which he resided was repeatedly plundered, he was himself never infested but on one occasion, by a robber who did not know him, but who was soon checked by the rest of the gang. When Dr. Richardson went from hence to the frontiers of Manipúr last year, he heard every where on his route the most pleasing accounts of the charity and active benevolence of old D'Amato. The Burmese of all classes respected him greatly, and when he was seized and put in irons by an officious officer, at the time the English army was advancing from Pagan, the moment the king heard of the circumstance, he ordered D'Amato to be released, observing, "He is like a god; why should we molest him?"

He was intimately acquainted with both the Pali and Burmese languages, and was allowed to be deeply read in Burmese scriptures, knowing more about them, a *Woongyee* once told me, than some of the best informed among themselves. He gave me some curious drawings and explanations in Burmese of the Búdhist cosmogony, geography, &c. I hope to send them to you some day with my translations.

D'Amato was a respectable painter, and as he knew something of natural history, he had made a collection of drawings of about 300 non-descript plants and flowers, and about 200 animals, writing down at the same time all he could learn as to the *habitat*, properties, &c. of each. He had bound the whole in four folio volumes, two containing the drawings and two the explanations. These volumes had occupied his leisure hours for nearly forty years; but when the late war broke out in 1824, he was apprehensive of some accident to himself, and he delivered these books to the charge of one of his flock residing at the village of Men-ge-la-goun. After the last Burmese army was defeated at Pagan, the king ordered some additional defences to be constructed around this city, and all the approaches to it were cleared; Men-ge-la-goun was burnt and plundered: a private soldier, it was said, got possession of D'Amato's books, and the prettily coloured drawings, in them induced him to carry them to the Queen's brother, Mengagyee, who gave the soldier a *patsho* or cloth, and kept the books. Report added, the Mengagyee had cut out most of the pictures, and stuck them up in different parts of his house.

The moment I learnt all this from D'Amato, I applied to the king himself, and to all the ministers, urging them, in the strongest terms, to have these books restored to their poor owner. I told them plainly, that as these books contained no political information, but related entirely to objects of general science, the king and the whole of his

court would be considered as a set of the greatest barbarians by every civilized nation, if works of such a description, belonging to a priest, were not forthcoming. The king repeatedly ordered every search to be made, and the ministers, to do them justice, exerted themselves to recover the books, but without success. Mengagyeo denied all knowledge of them, and had me taken into the inner apartments of his house to prove to me that they contained no such drawings as those belonging to D'Amato. I believe the king and his ministers were sincere in their desire of recovering the books; but I am sorry to say, that I have never been able to discover what has really become of them, although, supposing that they might have fallen into the hands of some private individual, I offered a very large pecuniary reward to any one who would produce them. It was pleasing to see, when I gave up the inquiry, with what pious and Christian-like resignation poor D'Amato submitted to this loss of the fruits of so many years' labour.

D'Amato is to be buried in great state, and his body is preserved in honey, until the whole of the Christians in this quarter can assemble, and pay the last honors to the remains of their venerated pastor.

I may mention here, that the inhabitants of the five Catholic villages in the district of Dibayen are the descendants of certain French and other prisoners, whom Alompra took at Syriam, in 1756, and brought up and settled here. Many of these Christians still show their descent in the light colour of their hair and eyes; but besides the descendants of the Syriam captives, it is reported, that in those villages, and at another village near Mouttshobo, there are many persons with light-coloured hair and eyes, who have a tradition, that their fathers were shipwrecked somewhere on the coast of Arracan, and brought up and detained in this part of the country, so far back as in the reign of some *fortieth* king from the present monarch. Possibly some of them may be descended from those English establishments which Dalrymple relates as having existed at Ava and to the northward, on the borders of China, about the beginning of the 17th century.

In the month of June, last year, D'Amato was joined by two young colleagues from Rome. They came to Rangoon via Egypt and the Red Sea, accompanied by a *Bishop of Ava* by name Fredrico Cao, and another priest, who are now residing at Moulmein. The two priests who have come up here, Antonio Ricca and Domingo Tarali, are natives of Italy, and appear to be intelligent, amiable young men. The Pope must have strengthened his Ecclesiastical

Establishment in this kingdom, with a view, I presume, of making converts. Hitherto, the Catholic clergy here appear to have confined their labours to their own flock, without any desire of increasing it. Besides the number of Catholics in Dibayen and here, there are about 260 souls at Rangoon under a *Padré* Don Ignatio; and many of these are wealthy enough to build themselves a good brick Chapel, which they have lately done. The Catholics near Ava live and dress like Burmese, from whom, I am sorry to say, they cannot be distinguished by any superiority in moral or intellectual qualities. *Père* Domingo is now residing at Khyan-ta-roowa, and *Père* Tarali at Ngabek.

#### IV.—*Oriental Accounts of the Precious Minerals.*

[Translated by Raja Kalikishen; with remarks, by James Prinsep, F. R. S. &c.]

I have been favored by Raja Kalikishen, with some interesting extracts from oriental works, respecting the precious minerals, which I have embodied in the present notice, with such modifications, as appeared necessary to suit the mineralogical reader, and with the addition of a few remarks in elucidation of the subject arising from a reference to the original works obligingly lent to me by the Raja, as well as from an examination of the rough minerals themselves, where I could procure them from the native jewellers. I trust that the Raja will continue his translations from similar works, both Persian and Indian, as nothing can conduce more to a right knowledge of that, at present, obscure subject, oriental mineralogy. A great variety of mineral substances are sold in the bazars of India, and included in its *materia medica*, of the proper classification of which we are as yet altogether ignorant.

The information contained in the present notices is extracted from three books, of different ages: 1, the *Ajâib-ul-makhlukât o Gharâib-ul-moujudât*, an ancient Persian work on natural history, written by *Zakarya*, a native of *Kufa*, date unknown; 2, the *Aqul-i-ashreh*, a work on science, by Mahomed of Berar, An. Hej. 1084, (A. D. 1673;) and 3, the *Juwâhir-nâmeh*, a modern anonymous compilation, containing much useful matter in a condensed form: it was probably written at one of the native courts, either Delhi or Hyderabad, since it mentions the opening of recent mines in India.

The two former volumes comprise sketches of all the different sciences known to the ancients. The third, as its name denotes, particularly treats of mineralogy. The Raja has not attempted to give a verbal

translation of either, and I shall follow his example in merely gleaning the facts which appear curious, or peculiar to oriental ideas.

#### THE DIAMOND.

A. *almús* ; G. *adamas* ; S. *híraka* ; H. *híra*.

In Arabic and Persian works of natural history, Aristotle is generally quoted as the chief authority whence information is drawn, and the most vague and fabulous tales of the origin and qualities of natural substances, are laid to his account; many no doubt with justice, but more without any authority whatever. Thus, of the diamond, some authors assert, that when Alexander visited the mountain *Zubnât*, (others call it *Sarandip*,) where the inaccessible valley of diamonds is situated, he directed pieces of flesh to be thrown in as the only means of procuring the gem:—vultures picked up these with the precious stones adhering to them, and dropped them in their flight, on various parts of the earth, where alone they are now discovered! It must be confessed at least that we have no theory of the *origin* of the diamond to offer in lieu of this oriental hypothesis.

The *Aqul-i-ashreh* does mention in general terms, that there are mines in the south-east of *Hindusthan*. The *Jawáhir-námeh* is more explicit, and notices a new mine opened in southern India, at *Kompila*, between *Mahali* and *Bijapúr*, near *Masulipatam*.

The *Jawáhir-námeh* describes the mode of digging for the ore, and washing the sand or gravel. The similarity between the diamond and rock crystal, both met with in the same matrix, has given to the latter the appellation of *kacha*, or *unripe*, and to the real gem, that of *pakka*, or *ripe*, diamond.

The diamond is supposed by some to be a preservative from lightning, and to cause the teeth to fall out when put in the mouth, but this is objected to by one author, on the ground, that diamond powder has been used for tooth-powder with no bad effects.

The *triangular* (tetrahedral) form of the pulverized fragments is noticed: also the natural cleavage, which is adroitly taken advantage of by the native *hakáks*, in forming table diamonds, by striking the stone between two sharp-edged tools.

Some knowledge of the combustible nature of the diamond might almost be inferred from a passage in the *Ajaib-ul-makhlukát*. “If it be exposed to the strong heat of a wind furnace, it will be melted\*,”

\* The original passage is as follows, and I am not sure that I have given the correct translation:—

اگر الماس را دودم نفیس اندازی و براتش عرضه کنی گداخته شود و آن نافع از برای دفع مذهب و فساد معدوم

probably alluding to the rounding of its edges by slow combustion. *Zakarya* also says, that if mixed (fused?) with pure sal ammoniac, the diamond will dissolve, but not with lead, *sarb*; probably the oxide of lead is intended.

“The great mart for diamonds formerly seems to have been at *Kal-bargah*, to the west of Hyderabad, where a clear rough diamond of two carats would sell for 7 *filori*, (a gold coin; the etymology of the word is not evident, perhaps it may be a corruption of florin.) When dressed, the same stone would fetch 15 *filori*. The European lapidaries are stated to be the only workmen who can by cutting and polishing fully develop the brilliancy of the diamond.”

#### RHOMBOHEDRAL CORUNDUM OR SAPPHIRE.

A. *yaqūt*; G. *ακασσα*? S. *manikya*; H. *manik*.

Under the name of *yaqūt* are comprised all those stones of the sapphire and ruby species, which are distinguished (or rather connected, as being chemically one) by the epithet *oriental*, in English books of mineralogy, and are now classed together under the general head of corundum, because they are composed of the same earth, alumina, as the corundum or *kúrún* of the Indians. The natives, like our own mineralogists, distinguish four principal species of *yaqūt*; red, blue, yellow, and white, or colorless.

The first, or ORIENTAL RUBY, A. *yaqūt-ahmar*, H. *manik*? exhibits seven varieties of colour, viz. *mihrmátí*, striped; *arghwání*, hyacinth; *rumání*, bright-red, or pomegranate; *rúí*, brass-colored; *khamrí*, red-wine-colored, the AMETHYST, H. *nagína*; *lahmí*, flesh-colored; and *khylí*, or asafetida-colored.

“Not to be deceived in rubies, is a work of difficulty, because there are spurious ones of polished crystal, which much resemble the true gem; these are called *áyn-ul-raján*: but a skilful lapidary will easily recognize them. When placed in the fire, a true ruby becomes invisible, but when immersed in water, it appears to glow with heat: it also shines like a coal in the dark.”

The second is the ORIENTAL SAPPHIRE, A. *yakut-arzaq* or *qabúd*, *safir*; G. *σάφειρος*\*; H. *nilum*.

Of this, there are enumerated five varieties, viz.: *taúsi*, peacock-tail.

\* It is doubted whether the *σάφειρος* of the ancients was not rather *lapis lazuli* than the gem now called sapphire:—it was called *χρυσόσπαρος* from the yellow spangles in it. (*Theophrastus*.) Pliny includes it among the *cyani*, a general name for all blue stones: he says, “Causam nominis afferunt quod usque ad *vini colorem* accedens priusquam eum degustet, in violam desinat.” If the word is derived from the name of a colour, it may be from *asfar*; but that would signify yellow rather than purple wine.

blue; *asmání*, azure; *nílí*, indigo; *chaklí*, grey or collyrium; and *sabzí*, greenish.

The third or ORIENTAL TOPAZ, A. *yaqút-asfar* or *zard*, H. *pokhraj*,<sup>\*</sup> has four tints, viz. *narinjí*, orange; *káhlí*, straw; *shamái*, flame or lamp; and *turanjí*, citron-colored. This variety is said to stand the fire better than the others.

If the *yaqút akhzar*, or ORIENTAL EMERALD, be esteemed the fourth variety, then there is a fifth, "of more variegated tints but of less value," comprising probably such as are not transparent, common corundum, adamantine spar, *salam* [*silan*, or *ceylon*] stone? &c.

Gladwin translates *yaqút* and *yaqút surkh* as "topazes," in his English version of the *Ayccn Akbery*; the *yaqút rumani* (written *rahmání* in the MS. belonging to the College of Fort William) and the *yaqút kabúd* he calls the "sapphire:" and on one occasion he renders the *yaqút surkh*, "amethysts:" showing the confusion which prevails on the subject of these gems. That different species of the corundum, however, were intended by all, is evident from a table of specific gravities quoted by Abu Fazl from a work of *Abu Rihan-al-Birowni*, which closely agrees with modern results, and proves that the term *lál* (hereafter to be noticed) is confined to the Balas or spinelle ruby: the table reduced to decimal expressions is as follows:

| Name of Jewel.              | Spec. Grav.<br>by Abu Rihan. |                             | Spec. Grav.<br>by European tables. |
|-----------------------------|------------------------------|-----------------------------|------------------------------------|
| <i>Yaqút rumani</i> , ..... | 3.98                         | } oriental sapphire,....    | 3.97 Mohs.                         |
| <i>Yaqút sárkh</i> ,.....   | 3.75                         |                             | do.                                |
| <i>Lál</i> , .....          | 3.52                         | spinelle ruby, .....        | 3.52 do.                           |
| <i>Zamarúd</i> ,.....       | 2.75                         | rhombohedral emerald, ..... | 2.73 do.                           |
| <i>Bilor</i> ,.....         | 2.50                         | rock crystal, .....         | 2.58 do.                           |

The *Jawáhir-námeh* includes among the varieties of *yaqút*, the *áyn-ul-híreh* (cat's eye) and the *turmali*, from which latter word may, perhaps, be derived our *tourmaline*, though applied by us to a different mineral.

The *áyn-ul-híreh* (H. *lahsúniá*) is evidently that variety of the sapphire which mineralogists designate *chatoyant*, or *opalescent sapphire*, and which, when cut en cabochon, shews a silvery star of six rays, and is then termed *ASTERIA*. This must be distinguished from the common cat's-eye, a chatoyant variety of quartz with which it has probably been confounded by the oriental jewellers. Pliny also adverts to the two minerals: of the first he says, "*proxima candicantium est asteria: nata est in Karmania, &c.*" and he distinguishes it from an inferior sort of *astrios*, resembling common crystal, which comes also from

India and "*Pallenes littoribus*." There were several inferior sorts : 1, those called *ceraunia* in the east ; 2, the *astroites* much praised by Zoroaster ; 3, the *astrobolos* of Sadines, resembling the eye of a fish, &c. : all of these appear to have been varieties of the quartz cat's-eye. "The jewellers appraise the value of the *âyn-ul-hireh* according to the number or perfection of the threads (*zanâr*) visible in it, which should give the stone, when turned about, the appearance of a drop of floating water." This description accords with the quartz cat's-eye rather than with the *asteria* ; but there is some difficulty in reconciling the uncertainties regarding this mineral, and I have not been able to obtain the actual name of the *asteria* for the want of a specimen of the stone.

The *âyn-ul-hireh* probably, however, comprises both of the above minerals ; in the same manner as the *turmalî*, next to be mentioned of the varieties of *yaqût*, apparently embraces both the zircon and tourmaline families.

"To the *turmalî*, as being of a greenish yellow tinge, people frequently give the name of *zabarjad*, or beryl ? It is found in small rounded pebbles in the same rock or matrix as the other Ceylon stones."

An uncut specimen of *turmalî* and several polished stones, obtained from a native jeweller in Calcutta for examination, proved to be the "jargoons of Ceylon," or precious zircon. It had a specific gravity 4.56 ; hardness 7.0 ; fracture vitreous ; colour greenish, some quite transparent and clear ; form rounded, amorphous : inalterable before the blowpipe per se. The colorless *turmalî* is cut and sold as a false diamond, in the bazars of India. Davy says, that "the yellow varieties of the zircon are sold by the inhabitants of Ceylon as a peculiar kind of topaz ; the green as *tourmalines*\*, the hyacinth red, as inferior rubies, and the very light grey, as imperfect diamonds ; the natives being altogether ignorant of the true nature of this mineral. It is most abundant in the district of Matura, whence it has its common name in Ceylon of *Matura diamond*†."

Of the localities of the *yaqût*, it is only stated in two of the works before us, that the gem comes from the hottest part of the globe, "from the south near the equator." In the *Juzâhir-nameh*, however, the large island of Ceylon is said to be its only habitat, where it is generated in caverns from the suppuraction and solidification of the essence of water ! "The natives dig wells in these places, and wash the sand

\* In Rees' Encyc. the Singalese name for tourmaline is stated to be *tournamal*.

† In speaking of the hyacinth (which among us is a variety of the zircon) Pliny says, "*Hunc colorem Indisæon vocant, et talem gemmam sacodion*."

extracted from below, for the various minerals which are disseminated in it."

The medical properties of this gem are remarkable: "it purifies the blood, strengthens, quenches thirst; it dispels melancholy reflections; and, as a talisman, averts dangers, insures honor and competence."

In hardness it only yields to the diamond: it is unaltered by the fire, the red and yellow varieties, if any thing, improving in color therefrom. The blue, or sapphire, when pure, is of equal value with the diamond. The Arabs are fond of engraving their names upon it.

Besides the *Sīlanī* or Ceylon *yaqūt*, there is stated in the *Jawāhir-nameh* to be "another ruby, now very much in vogue, which is extracted from a mine in Bengal, near *Tahat-ul-Surāa*, in the vicinity of which is an island, called *Rakhang*, nigh to which is a stream, where also the ruby is procured." *Tahat-ul-surāa* may mean a deep mine; *Rakhang* is the Arracan of Europeans. "It is greatly valued in *Hindūsthan*. Jewellers assert, that its nature is soft, and that fire will dissolve it, but from its appearance or touch no idea can be formed of these defects." This account may refer to the spinelle ruby about to be described, or to a species of garnet.

#### DODECAHEDRAL CORUNDUM OR SPINELLE RUBY.

P. *lāl*; H. *manik* ? or *lāl*.

Concerning this gem there is considerable incertitude among oriental authors, which an acquaintance with mineralogy alone can dissipate. Jewellers of the present day apply the term *lāl* to all rubies of a fine red color. It is evident however from the books before us, that the *lāl* is quite distinct from the *yaqūt*, and that it properly designates what we term the *spinelle*\* ruby. The *lāl rumani*, scarlet or pomegranate-coloured ruby, is probably the true SPINELLE; while the *lāl Badakshānī*, or ruby of Badakshan, of a rose color, is what Europeans call the BALAS RUBY; indeed it appears possible that Balas may be a corruption of the latter name; for, the French Encyclopedia says, the name is derived from the kingdom whence the rubies come, supposed to be situated, vaguely, somewhere between Pegu and Bengal. *Balkh*, the capital of Badakshan, might have been written *Balach* in French, and afterwards softened to *Balas* by the same process which has converted the *Khan* into the *Cham* of Tartary.

\* The etymology of the word *spinelle* is obscure—Tavernier describes among Indian varieties of the ruby, the "*spinels* or *mothers of rubies*."



The Persian authors are particular in their description of the locality and origin of this stone. "The mine of this gem was not discovered until after a sudden shock of an earthquake, in *Badakshan*\*, had rent asunder a mountain in that country, which exhibited to the astonished spectators a number of sparkling pink gems of the size of eggs. The women of the neighbourhood thought them to possess a tingent quality, but finding they yielded no coloring matter, they threw them away. Some jewellers, discovering their worth, delivered them to the lapidaries to be worked up, but owing to their softness the workmen could not at first polish them, until they found out the method of doing so with *mark-i-shisá*, marcasite or iron pyrites. This gem was at first esteemed more than the *yaqút*, but as its color and hardness were found to be inferior to the latter, it became less prized."

There are many varieties of color: red, yellow, and greenish, but the *piázi*, reddish yellow or onion-colored, (the *rubicelle*?) and the *mina*, violet-colored, (the *almandine* ruby?) are held in the highest estimation; of the red there are given eight tints, wine color, date color, Brazil wood color, &c. which it is needless to enumerate. The author of the *Jawáhir-námeh* says: "as the *lál* ruby did not exist in the time of *Jemshíd*, no mention of it is to be found in ancient works; modern physicians ascribe to it the same medicinal qualities as the *yaqút* possesses."

In a manuscript history of Cashmír and the countries adjacent, by Abdúl Qádir Khan, Benares, 1830, is the following description of the manner of extracting rubies from the *Badakshan* mines: it professes to be taken from an oral account by Mirza Nazar Báki Bég Khán, a native of *Badakshán*, settled at Benares.

Having collected a party of miners, a spot is pointed out by experienced workmen, where an adit is commenced. The aperture is cut in the rock large enough to admit a man upright: the passage is lighted at intervals by cotton *nasháls* placed in niches; as they proceed with the excavation, the rock is examined until a vein of reddish appearance is discovered, which is recognized as the matrix of the precious gem. This red colored rock or vein is called *rag-i-lál*, or, the vein of rubies; the miners set to work upon this with much art, following all its ramifications through the parent rock.

\* The *Manáif-ul-ahjár* dates this occurrence "350 years ago," but the date of the work is not given: the *lál* is not mentioned by *Zakarya*. Since the above was written, Mr. H. H. Wilson has favored me with a sight of another work on jewels, entitled *Khawás-ul-hejár*, translated by himself, in which the *lál* is treated of under the name of *balaksh* (*Balakshan* being synonymous with *Badakshan*). This leaves no doubt as to the origin of the word Balas. *Banaksh* is also described as a variety of inferior quality and no value. The word is not used by other authorities.

The first rubies that present themselves are small, and of bad colour : these the miners called *piadehs* (foot soldiers) : further on some larger and of better colour are found, which are called *sawars* (horse soldiers) ; the next, as they still progress in improvement, are called *amirs*, *bakshis*, and *vazirs*, until at last they come to the *king jewel*, after finding which, they give up working the vein : and this is always polished and presented to the king. The author proceeds to describe the finest ruby of this kind that had ever fallen under his observation. It belonged to the Oude family, and was carried off by Vizir Ali ; he was afterwards employed in recovering it from the latter : it was of the size of a pigeon's egg, and the color very brilliant ; weight, about two tolas ; there was a flaw in it, and to hide it, the name of *Julál-ul-dín* was engraved over the part ; hence the jewel was called the *lál-i-jaláli*. A similar ruby to this, but considerably larger, is in the possession of *Runjit Singh*, and has the names of five emperors engraved upon it.

The bright-red spinelle ruby, *lál ramáni*, is called by modern jewelers *yaqút narm*, or simply, in Hindústani, *narmeh* ; also *lálrí* : it comes from Pegu\* and Ceylon, and less frequently from the north.

#### THE RHOMBOHEDRAL EMERALD.

P. *zamarúd* ; G. *σμαράγδος* ; S. *markat* ; H. *panna*.

The mines of this gem are stated in the Persian works to be situated in the "extreme west," in Barbary, and the upper parts of Egypt. It bears a higher value in India, on account of its entirely foreign origin ; it is soft and seldom free from flaws, sp. gr. 2.70. The medical and talismanic properties of the emerald are, averting bad dreams, giving courage, curing palsy, cold, and bloody flux. There is a close connection between the *zamarúd* and the *zabarjad*. Zakarya says, the names are synonymous, and that the true color of the emerald is a *brilliant yellow*, (chryso-beryl?) adding on the authority of Aristotle, that it is frequently met with in gold mines.—Mahomed of Berar says, that "the *zabarjad*, although reckoned the best kind of emerald, is, in fact, another stone of higher value, and now scarce." The *Khazás-ul-hejár* describes it as possessing none of the qualities of the emerald, and of an inferior greenish color. The name of *zabarjad* is therefore probably applied indiscriminately to varieties of the beryl, the chrysolite, and the topaz†.

As no separate mention is made of the topaz, it must be considered as really classed in the same family with the emerald and za-

\* *Takt-ul-Surda*, mentioned in a former page, may be a corruption of *Syriam* in Pegu, the great mart for spinelles and *yaqúts* from the Capellan mountains.

† The topaz of the ancients is supposed to have been the chrysolite of moderns, and vice versâ. Pliny classes it among his *gemmis viridibus non translucentibus*. "Egregia etiamnum topazio gloria est suo virenti genere."

*barjad*. This may be easily accounted for by the similarity of their prismatic crystallization: beryl or aquamarine, a variety of emerald, passes from green into a yellow color: and the striated prisms of topaz pass from a deep golden yellow to a pale green color. Their difference in specific gravity and chemical composition could not be known to a lapidary; their hardness is nearly the same, and they occur in the same mines in Egypt and elsewhere: indeed the term beryl was applied to both by Werner. The aquamarina or beryl is called *berúj*: specimens shewn me had a specific gravity 2.70. The Indian name for topaz is *pákhráj*, whence has been taken the modern Arabic appellation of topaz, *buszák*.

#### THE TURQUOIS.

P. *firozeh*\*; G. *καλλαις*; S. *péroj*?

The name *Firozeh* is said in the *Jawáhir-námeh* to have been given to this stone by Firoz Shah, but this must be matter of doubt; as also whether the Sanskrit synonyme in Hunter's Dictionary, *péroj*, is not a corruption of *berúj*, beryl, quite a different stone. From the localities and from the characteristics of the two varieties in the books before us, it might be conjectured, that the two species of this mineral known to European mineralogists, as the *calcite*, or mineral turquois, and the *odontolite*, or bone turquois, are equally familiar to the Persian jewellers, under the epithets of *Abu-Is'haqi* and *Badaksháni*.

The *Abu-Is'haqi*, (father of Isaac,) or genuine turquois, is the produce of the mines of *Ansar*, near *Nishapur*, in Khorasan, (the same place mentioned as *Michebourg*, in Tavernier's Travels in India.) All authorities concur, that these are the only turquois mines in the world: the stones are said to vary from pale blue to green and white, but all except the azure are worthless. A curious fact is mentioned also, which, from the nature of the mineral† may be readily believed, though it has not been observed in Europe: "the real blue turquois of *Nishapur* changes its color when kept near musk or camphor, also from the dampness of the ground, as well as from exposure to the fire‡; the inferior stones become discolored even without this test," by gradual decomposition or efflorescence. The *Khawás-ul-hejár* makes the clearness or dulness of the turquois vary according to the atmospheric changes. "It brightens the eyes; is a remedy for ophthalmia and bites of venomous animals; it is used in enamelling sword handles, &c."

\* *Firozeh nakis*, an inferior turquois, is enumerated amongst the mineral products of *Tibet*, by *Abdul Kadir Khan*, in the History of Cashmir before quoted.

† Vide GLEANINGS IN SCIENCE, II. 375.

‡ Pliny also remarks of the *Callais*; "quæ sunt earum pulchriores, oleo, unguento et mero colorem deperdunt."

“The *Badakshāni* turquoise essentially differs from the *Nishapūri* in being able to withstand the heat of a fire for ten days without alteration: for this quality it is much esteemed, although in other respects, not so good as the produce of *Ansār*.”

Now the *calcite*, which contains 18 per cent. of water, would be entirely destroyed by such an operation, while the *bone turquoise* is actually made in many places, by exposure to the fire of fossil bones impregnated with iron; and the fossil bones brought from the north of the Himalayan range, when exposed to a red heat, are found to assume the very appearance of *odontolite*\*: it is possible, therefore, that a supply of this artificial gem may find its way into Persia through Balkh, and take its name from that country as its known market.

Arguments are not wanting on the other hand to shew that the *Badakshāni* turquoise is nothing more than *lapis-lazuli*, or *lājaward*, and the descriptions of the two are mixed up together in the books before us, like those of the emerald and topaz.

#### LAPIS-LAZULI.

p. *lājaward*; s. *vaidūrya*.

“The country of *Badakshan* abounds in mountains, and contains several rivers. On the *Jihūn* (*Oxus*) river, near where the *Samarkand* road crosses it, is the mine of *lapis-lazuli*. This mineral has different shapes; one, like the egg of a hen, which is covered with thin, soft, and white stony coats, is reckoned the best when pounded, it needs neither washing nor polishing; the others are without covering and must be washed.

“The method of washing is this: first to pulverize it and afterwards to keep it wrapt in silk cloth, besmeared all over with gum *sandarach*, which should be previously softened in very hot water, and then rubbed over or kneaded with the hands; it is kept in the water for three days, until all the foreign matter has been washed out.”

This is exactly the process for manufacturing ultramarine from *lapis-lazuli*, given in *Ure's Chemical Dictionary*. “There is also a mine of *lājaward* in that part of *Kāshān* called *kharūl*, or minor. It is difficult to distinguish the *Kashāni* from the *Badakshāni* mineral, but there is a considerable difference in their value:—the following test is prescribed to recognize them:

“First rub the specimen on a piece of stone without water, and if in doing so it becomes dark, this immediately marks its spuriousness; secondly, put it in the mouth, and afterwards throw it into the fire; when it becomes red, take it out, and if it be not discolored, its

\* Vide *JOURNAL AS. SOC.* I. 77. *Theophrastus* enumerates *fossil ivory* of a lighter or darker colour, as distinct from the sapphire, evidently shewing, that the *odontolite* or bone turquoise was intended by *ελεφας ορυκτος*.

genuineness is established." "The *Káshání* mineral is of an antimonial colour, and is ground up for the painting of glass and porcelain." [It is possible that this description may refer to the *zaffre* mineral or sulphuret of cobalt.

¶ This last cursory notice, although foreign to the subject of the precious gems\*, arouses a curiosity to know a little more of the contents of the *Ajáib-al-Makhlúqat*, and I trust the Raja will continue his labours, confining himself as far as possible to a literal translation of his text.

### V.—*Proceedings of the Asiatic Society, Physical Class.*

Wednesday, 15th August, 1832.

Sir Edward Ryan, President, in the chair.

The proceedings of the last meeting having been approved, the following letters were read.

1. *From Capt. P. Gerard, dated Kotgurh, 23rd July*, announcing, that he had dispatched to the address of the Society, a box containing 164 paper parcels of fossils from the Himalaya, by direction of his brother, Dr. Gerard, their discoverer. He further acquaints the Society, that Dr. Gerard had forwarded from Cabul the first paper of his promised paper on the valley and section of the Spítí, illustrative of these fossils, and that the remainder is expected from Bokhara.

2. *From W. Cracroft, Esq. to Sir E. Ryan, President, dated Chirra Punji, 25th June*, announcing further discoveries of coal beds in the Kasya hills.

The present site is near a place called *Monthar*, where the coal seams occur between the sandstone beds, accompanied as usual with bituminous shale, limestone, and indurated clay; the coal strata altogether are six feet in depth: this locality is so far interesting, because it has been hitherto a desideratum to obtain coal near the foot of the hills equally good with what is found above: the specific gravity of this coal is stated to be only 1.31.

3. *From Dr. Alex. Turnbull Christie, dated Madras, 14th August*, stating, that he had been entrusted by the Geological Society of London with the charge of a series of casts of the fossil bones discovered in Ava by Dr. Crawfurd, for presentation to the Asiatic Society: further, in his own name, begging its acceptance of a small collection of fossil shells from the tertiary formations of France and Italy.

[The package has not yet reached Calcutta.]

4. *From G. Swinton, Esq. Chief Secretary to Government*, communicating a letter from the Rev. Wm. Vernon Harcourt, Secretary of the British Association for the Advancement of Science, by direction of the Central Committee, transmitting a copy of their first Report, and requesting his assistance in extending to India the operation of the plan detailed therein, by the formation of a Committee to correspond with the Association,

\* Lapis-lazuli, or azure stone, as has been already remarked, has been supposed to be the *σάπφειρος* of the Greeks.

to promote its objects, and to aid it in carrying on upon a common system, in the most distant parts of the empire, the extensive investigations which it meditates. Copies of the report have been also addressed to Sir E. Ryan, Major Benson, Dr. Christie, Captain Herbert, and Messrs. Calder and Prinsep, who have been requested to coalesce with Mr. Swinton as members of the Indian Committee.

The purport of submitting this letter to the Physical Class was to give publicity to the objects of the British Association, through the circulation of the Society's proceedings, that all who are inclined to undertake any of the trains of investigation pointed out in the published "recommendations\*," may know where they may address inquiries, or transmit the results of their observations.

Mr. J. Calder brought to the notice of the Society, as connected with the communication just made known, that since the death of Doctor Voysey, the situation of Geologist and Naturalist to the grand Trigonometrical Survey had remained vacant. He trusted that the present Surveyor General would not lose sight of the great advantages to science of such an appointment, when he should be preparing to continue his grand arc through the unexplored regions of Central Hindūsthan.

5. *From Dr. Strong*, with copies of correspondence with Col. Sir Thos. Arburey, Chief Engineer, respecting the pay of the men of the Sapper and Miner Corps employed in the boring experiment.

6. *From G. Swinton, Esq.* forwarding on the part of Colonel Watson specimens of Kasya iron ore, smelted iron, and coal; also some native caoutchouc, manufactured into bottles, and thin sheets, at Chirra Punji.

The latter may become a valuable article for many purposes; the sheets are very thin, pliant, and impervious to air or water.

The coal is of the slaty kind, sp. gr. 1.447, containing volatile matter 36, carbon 41, and a copious white ash, 23 per cent.

7. *From Dr. J. T. Pearson*, submitting his suggestions on the improvement of the Museum of the Asiatic Society.

After some discussion, and a vote of thanks to Dr. Pearson, for the labour he had taken in the consideration of a subject of such vital importance to the Physical branch of the Society,—Messrs. Calder, Troyer, Tytler, Everest, Wilcox, and C. Hunter, in conjunction with the President and Secretaries, were nominated a Committee to report upon the best mode of giving effect to the very desirable plan proposed by Dr. Pearson, previous to coming before the general meeting of the Society, with any application on the subject.

Dr. Pearson exhibited a part of his entomological collection, as an example of what might be effected towards the preservation of specimens in this country.

A fossil was presented by the Rev. R. Everest, supposed to be the vertebræ and ribs of a saurian animal.

*Papers read.*

1. Description of the *Canis primævus* of Nepal, by B. H. Hodgson, Esq.

\* These were printed at length in the last number of the Journal.

This interesting paper gives a particular account of the wild dog, of which a notice will be found in Mr. Hodgson's paper on the Mammalia of Nepal published in the present number: it is accompanied by accurate drawings of the animal, and, by way of comparison, of the "*chien de rue*," and the jackal; and of the skeletons of the head of each.

## VI.—SCIENTIFIC INTELLIGENCE.

### 1.—*Gold Mines of North America.*

Several new sites of gold ore have, within a few years, been discovered in the United States.

The gold mines of North Carolina, are acquiring importance rapidly, through the improvements in mining introduced by foreign miners. In Virginia also, since 1827, considerable attention has been attracted by the discovery of the precious ore along a belt of country extending through Spotsylvania and the neighbouring counties. In the latter State it is diffused over large spaces, and has not been found sufficiently in mass, except in a few places, to make mining practicable; but in North Carolina the produce has increased from D. 2,500 a year to D. 128,000 in 1829, and 204,000 in 1830.

The mint returns for 1830 state the receipt of gold from "the gold region of the United States," to be D. 466,000, of which D. 212,000 was from Georgia, whence no specimen had ever before been received; D. 24,000 from Virginia and D. 26,000 from South Carolina. The gold country was estimated by Prof. Olmsted, in 1825, at only 1,000 square miles, but it has since been found to be vastly more extensive, and a succession of mines has been discovered in the country east of the Blue Ridge, extending from the river Potomac into the state of Alabama, and ending in Tennessee. The gold works in the counties of Burke and Rutherford are *washings*: the gold is found in small and pure particles mixed with the sand, which lies in deposits, occupying as it were the beds of ancient streams, creeks, &c.

The counties of Mecklenberg, Rowan, Davidson, and Cabarras are the richest in what may be properly called gold *mines*; that is, where the gold is found in *ore*, and distinguishable by the eye, and where it is separated by pounding, and amalgamation with mercury, separating the latter from the gold by distillation in an alembic in the usual manner.

The gold region abounds in quartz, which contains cubical pyrites. These cubes are sometimes decomposed, and the cells thus created are filled with gold. The greatest portion of the metal, however, occurs in veins in slate.

"The best veins of gold are not horizontal, nor often vertical, but have a dip of about 45 degrees. They vary in width from a few inches to several feet: they are not confined to hills at all, but are found also in low lands. These veins are often parallel to each other at unequal distances: their depth in most places has not been ascertained, no shafts having yet pierced lower than 120 feet. The mining required a great deal of skill and experience in economizing the perforations and galleries. There are no less than thirteen different languages spoken at these mines, so speedily have adventurous miners been attracted from Germany, Switzerland, Spain, England, &c. Mills for grinding the ore, propelled by water or by steam, have been erected, and in one establishment alone more than 600 hands are employed. The state of morals among this heterogeneous mass of adventurers is represented to be deplorably bad.

"There is indubitable evidence, that these mines were known and worked by the aboriginal inhabitants, or some other people, at a remote period. Many pieces of machinery, which were used for this purpose, have been found. Among them are several crucibles of earthen-ware, surpassing in durability the best Hessian crucibles."

We have extracted the substance of the above notice from "*The American Almanac and Repository of Useful Knowledge, for the year 1832*;"—a small octavo volume, which puts to shame all the almanacks of our own country, with the exception of that published under the auspices of the *Society for promoting Useful Knowledge*, by the immense mass of information, calendral, statistical, and physical, which it contains, as well as by the method of its arrangement and the neatness of its execution.

2.—*Analysis of the Copper Ores of Cuba, in the Cerco of Villa Clara. By Don Ramon de la Sagra.*

The specimens produced belong to the class called green copper (*cobres verdes*), or the carbonate of copper of mineralogists. Some pieces have an earthy appearance, and are soft, friable, and of a whitish-green colour, like certain copper ores of Rio Tinto, in Spain, commonly called "*verde de montana*." Others are more compact, of a sea green, and sometimes a metallic grey. The oxide of iron with which it is combined is very perceptible to the eye. In order to separate it, I pounded specimens of both descriptions of ore, then distilled and calcined two grammes of each, to ascertain the quantity of water and of carbonic acid, and dissolved the mass in boiling nitric acid: after concentrating the solution, filtering it, washing the residuum, and mixing together the water employed in the washing, I obtained 65 centigrams of precipitate from one mineral, and 38 from the other, by means of liquid ammonia. These quantities of ammoniac of iron corresponding to 32 and 18 centigrams of metal respectively, or 16 centesimals of iron from the former, and 9 from the latter. The whole contents being,

| 1st SPECIMEN.                        |             | 2nd SPECIMEN.                        |             |
|--------------------------------------|-------------|--------------------------------------|-------------|
| <i>Green copper, earthy ore.</i>     |             | <i>Green copper, compact ore.</i>    |             |
| Sub-carbonate of copper, (hydrated.) | 64 5        | Sub-carbonate of copper, (hydrated.) | 56 5        |
| Oxide of iron,                       | 22 5        | Oxide of iron,                       | 13 0        |
| Silex and earthy residuum,           | 13 0        | Earthy residuum,                     | 30 5        |
|                                      | <hr/> 100 0 |                                      | <hr/> 100 0 |

3. *Coal from the district of Guanah, in the island of Cuba, analysed by Don Ramon de la Sagra.*

Texture laminar, of a bright lustre, like the best coal of England—fracture cubical—specific gravity 1.18.

| CONTENTS.                             |    |    |           |
|---------------------------------------|----|----|-----------|
| Carbon or combustible matter of coke, | .. | .. | 60        |
| Betun mineral, (Tar,) ..              | .. | .. | 20        |
| Water, ..                             | .. | .. | 4         |
| Incombustible ashes, ..               | .. | .. | 12        |
| Gas, ..                               | .. | .. | 4         |
|                                       |    |    | <hr/> 100 |



## VII.—Progress of European Science.

## ELECTRICITY.

Our journal has hitherto adverted but little to the subject of European science. Our space has been too fully occupied to admit of copious extracts from the scientific periodicals of England, and of the continent; we have confined ourselves to the reprinting of such notices in natural history, as were immediately connected with India. There is consequently a large arrear to bring up in other branches of science, and we must seek the means of doing so rather in the shape of a general review, than of broken and detached extracts. Fortunately, the materials for such a review are for the most part prepared to our hands, in the papers and essays read at the Academie, the Royal Society, and the Royal Institution; and in the annual addresses of the Presidents of other scientific bodies. It is a commendable rule of the French academy, that all works and papers presented, instead of being read at random and at length, are first referred to a *commission*, whose report generally condenses the original matter into a short and lucid abstract, much fitter for perusal before a mixed audience, or by the general class of readers. It is from such sources that we propose to gather our information.

ELECTRICITY is one of those invisible agents of nature, to the development of the effects of which attention is at this moment powerfully directed, on account of the discovery of several new phenomena, partly by accident, but chiefly by well-conducted experimental investigation. We shall endeavour to lay before our readers the progress that has been made, in these researches, under two heads:—1st, as connected with chemistry;—and 2nd, as connected with magnetism. The time seems near at hand, when the principle which actuates the *triune* sciences of galvanism, magnetism, and chemistry, will be acknowledged to be one only, under the name of *vis electrica*, subject to as simple and invariable laws as those of the gravitating principle, although like the latter its actual nature may ever remain a mystery to our limited comprehension.

## 1.—Electro-Chemistry.

If anything proves how far we are from a right understanding of the theory of the development of electricity in the voltaic pile, it is the diversity of opinions among philosophers who have especially engaged upon this inquiry.

VOLTA conceived that the simple contact of two solid conductors, such as the two metals, zinc and copper, produced electricity; and he thought that the liquids interposed between the couplets of the pile served only to transmit the electricity of one to the next.

An observation made in France, by Messrs. BIOT and FRED. CUVIER, proved the influence of atmospheric oxygen in the charge of the pile; for having placed it in a receiver full of air, resting upon water, the action of the pile went on diminishing as the oxygen of the air became fixed on the zinc, and finally stopped when nothing but azote was left in the receiver.

WOLLASTON sought to prove, that the electricity of the pile proceeded from the chemical action of the liquid, interposed between the couplets, on the metals of the latter.

DAVY, while admitting the principle of VOLTA, regarding the development of electricity by contact, recognized the necessity of a chemical action between the liquids and the metals which formed the pile, to produce a charge.

Lastly, M. NOBILI starting from the fact, that *an electric current is established in a metallic bar unequally heated*, concludes that, in the pile, the action of liquids on metals develops electricity, because it develops heat, which is unequally communicated to the metals.

The electricity of the pile then has been attributed to three causes, viz. to simple contact, to chemical action, and to heat.

M. BECQUEREL, for the last ten years, has been engaged in a train of researches which have greatly added to electro-chemical knowledge: it is he who has proved, in an incontestible manner, *the development of electricity in chemical action*, a fact of the highest importance; he has proved besides that, if it be true, as asserted by DAVY, that an acid and a solid alkali, become, by contact and before their mutual combination, the first electro-negative, the second electro-positive; it is not true, as the illustrious English philosopher has maintained, that at the moment of combination their electricities neutralise each other, for his experiments prove on the contrary, that *a current of positive fluid then arises from the base to the acid*.

He has shewn besides, that *two liquids of different nature may assume different states of electricity, and thus form the elements of a pile*.

These discoveries, the fruit of very delicate and ingenious experiments, naturally led their author to study the pile, not so much in respect to a general theory, as with a view to an experimental analysis, such as should determine with some precision the causes that influence its charge.

M. BECQUEREL, in the first chapter of a work submitted to the French academy, treats of such of these causes as are due to chemical action; and his experiments are directed to submit one element of the pile, as much as possible, to the influence of a single cause productive of electricity.

Speaking of the action of different liquids on one another, he gives a sufficient number of experimental results, from which it appears that *an acid conducts itself with a saline solution with which it mixes, as it would with a salifiable base with which it would combine, that is, it is positive towards it*. It seems also, that phosphoric acid is positive, relative to the muriatic, nitric, and sulphuric acids; a fact curious enough.

M. BECQUEREL, in examining the electricity developed by the contact of metals, and of those acids which attack them, or of metals and saline solutions, proves in general, that in the action of an acid on a metal, particularly when this action is not very strong, *the greatest part of the electricity developed, proceeds not from the action of the metal on the acid, but from the mutual action of the solution of salt produced and the free acid*.

Copper, lead, bismuth, zinc, and iron plunged in their respective nitrates become *negative* by the addition of a few drops of nitric acid; while those metals which decompose water, iron, zinc, and manganese, plunged in their respective sulphates, become *positive* as soon as some drops of sulphuric acid are added.

M. BECQUEREL then takes up the subject of the electric effects produced when two metals, connected by means of the wire of the multiplier, are partly plunged, either in the same liquid or in different liquids communicating together. In this case it is *generally the mutual action of the liquids, and not the action of either liquid upon the metal, which produces the greatest electric effect*.

He observed also, that in a pile formed of copper and zinc; the maximum electro-magnetic effect is obtained when the copper is plunged in nitrate of copper, and the zinc, in sulphate of zinc; because, if the copper and the zinc become, one positive, the other negative,—the nitrate of copper by its contact with the sulphate of zinc becomes positive, whilst the second becomes negative, consequently the sum of electricity developed is then the greatest.

M. BECQUEREL perceived that one way to preserve electrical effects sensibly constant during a certain interval, in a voltaic element formed of two metals, was to prevent their surfaces from becoming covered with solid deposits : unfortunately the process he adopted to obviate this defect is not of easy application in the ordinary construction of the pile, nor is it explained in the report.

Before entering upon the processes of electro-chemistry that he has employed to produce new chemical combinations, he describes an old experiment by BUCHOLZ, founded on the same principles.

BUCHOLZ, having introduced into a narrow receiver, containing a solution of sulphate of copper surmounted by plain water, a plate of copper, so that its upper part was immersed in the water, and the lower part in the sulphate, observed, that this part became soon encrusted with metallic copper : M. BECQUEREL supposes that, in this case, the two liquids form a voltaic couple, of which the solution is the positive pole and the water the negative.

When the slip of copper is immersed, a current of positive electricity is established from below upwards ; thus the plate becomes a pile of which the base is negative, and the summit positive ; and as a simple consequence, the copper is transported to the negative pole.

The possibility of thus establishing piles of single pairs formed either of two solids, or of two liquids,—and the property enjoyed by oxygen of travelling quicker than do the acids to the positive pole of these piles, which have always a very feeble tension,—led M. BECQUEREL to avail himself of electro-chemistry, to obtain several compounds of a remarkable nature, whether from their resemblance to the natural products met with in the strata of the earth, or from their similarity to certain products of the chemist's laboratory. As an example,

He put into a closed tube some concentrated muriatic acid, and a piece of charcoal fixed to a slip of silver by a wire of the same metal ; the open end of the tube was then drawn out to a fine thread with the blowpipe, but not closed. At the end of several months, there were formed upon the lamina of silver, octohedric crystals of chloride of silver, 0.001 metre (0.01 inch) in diameter, which resembled exactly those of nature ; while from the charcoal was disengaged some gas supposed to be carburetted hydrogen. The rationale is as follows : the charcoal and the silver form together a pile, of which the former is the negative pole ; hence the hydrochloric acid is decomposed,—the chlorine goes over to the silver with which it combines, while the hydrogen goes to the negative pole. When copper is substituted for silver, protochloride of copper is deposited in tetrahedric crystals.

Protoxides of copper, of lead, the oxide of zinc, &c. have all been obtained in crystals by the following process : taking copper as an example : in a glass tube, a convenient portion of deutoxide of copper is placed, and a saturated solution of nitrate of copper, along with a slip of the same metal which ought to touch the deutoxide. The tube is then hermetically sealed ; the nitrate in contact with the deutoxide gradually passes to the state of insoluble subnitrate : then the lower part of the solution being less charged than the upper, acquires negative electricity, whilst the upper becomes positive ; a current commences therefore from above downwards, so that the lamina is itself a pile, of which the positive pole is below, and the negative above. It is natural, therefore, that the protoxide of copper should transport itself and crystallize on the upper extremity of the lamina.

Finally, M. BECQUEREL has formed double chlorides, bromures, iodures, sulphurets and cyanurets, crystallized under the influence of electro-chemical forces. Thus to obtain a double chloride of copper and sodium, he takes a tube curved

like the letter V. He fills the curved part of it with *kaolin*, (porcelain clay,) previously boiled in acid; he then fills one branch of the syphon, with a solution of chloride of sodium—the other with one of nitrate of copper; lastly, a bit of copper-wire is put into each, and the openings are closed with mastic.

The two solutions upon their gradual mixture acquire different states of electricity: the wire plunged in the nitrate becomes negative, while that in the chloride remains positive; the nitrate of copper is decomposed, and its metal deposited upon the wire which is plunged into it, whilst the oxygen of the base transports itself to the positive wire plunged in the chloride and thus produces a *double* chloride, because a portion of this chlorine unites with the metallic wire, and the chloride of copper resulting combines with the chloride of sodium. The greater part of the nitric acid remains free in the branch where the copper is deposited.—*Journal des Savans*, Jan. 1831.

In the proceedings of the Royal Institution of February last, we also find the following notice of some experiments made by Dr. RICHIE, on the laws of action in an elementary galvanic battery, and their application to the laws of a compound battery.

“Dr. RICHIE's experiments proved, that VOLTA's electro-motive theory was incorrect, and that decided voltaic effects could be produced by one metal and one fluid. He attempted to account for the deflection of the needle and the decomposing powers of an elementary battery, without supposing any *actual* transfer of the electric fluid from the zinc through the fluid to the copper plate, by the definite arrangement of the molecules of water. He shewed that the electro-magnetic effects are nearly inversely as the square roots of the distance between the plates: and that the effects of two unequal batteries were nearly as the square roots of their lengths. When their lengths were much extended, as is the case in an elementary battery, the increase of power begins to deviate from this law, and to verge to a limit beyond which any increase in the number of plates would diminish their powers.”

## II.—Electro-Magnetism.

In the *Philosophical Transactions* for 1831, is an essay by Mr. BARLOW, on the Probable Electric Origin of all the Phenomena of Terrestrial Magnetism, which gives so clear a view of the progress of researches on this most interesting branch of electricity, that we regret our limits do not allow us to present it to our readers at length; the following is a summary of its contents.

The facts relative to terrestrial magnetism collected during the scientific travels of M. HUMBOLDT were the first to awaken inquiry as to the laws of terrestrial magnetism. The difficult task of reducing that eminent traveller's results to calculation fell to the lot of M. BIOT.

“Considering the earth as a magnet, he assumed an indeterminate distance to represent the distance of its two poles; and then, supposing their power to vary inversely as the square of their distance from the point on which they acted, (a law which had been already established,) he obtained a general expression for the direction of a magnetic needle; he then made his indeterminate distance vary; and comparing at every step his results with those observed, it was found that the nearer the poles were made to approach, the nearer the computed and observed results corresponded; and finally, that the errors were reduced to a minimum when the two poles were coincident, or indefinitely near to each other.” This

important result demonstrated that the earth was not a magnet, according to the common property of which the poles are distinct and distant from one another.

The intricate formulæ of M. BIOT when simplified, were found to agree with an empyric relation discovered by M. KRATZ of Petersburg, in examining some observations of the magnetic dip in different parts of the world; namely, "*that the tangent of the dip of the needle in any place is equal to double the tangent of the magnetic latitude of that place.*" It followed also from BIOT's formulæ, that *the intensity of the dipping needle ought to vary inversely as the square root of four, minus three times the square of the sine of the dip; and that of the horizontal needle, inversely as the square root of three, plus the square of the secant of the dip*: conditions which have in a great measure been verified, but which call for further confirmation in every quarter of the globe.

These laws are entirely inconsistent with those of a permanent magnetic body; while Mr. BARLOW shows, they are the fundamental laws of a body which receives its transient magnetism by induction; and resemble precisely the conditions of the iron sphere upon which his experiments were made in 1819\*, where the remarkable fact was pointed out, that all the magnetic power of an iron sphere resides on its surface.

Still an insuperable obstacle seemed to oppose itself to any rational hypothesis, relative to the cause of the earth's magnetic power. At that time only one means of inducing magnetism was known, which was by the approximation of a permanent magnet to a ball, or mass of simple iron, and of one or two other metals; the cause, therefore, remained inexplicable, until the important discovery of M. ØERSTED, that *a wire conducting an electric current was during the interval of transmission in a state of magnetic induction.* A number of interesting facts were immediately brought to light, founded upon this grand discovery, by the researches of M. AMPÈRE, BIOT, and FARADAY. Mr. BARLOW sought in it directly for the explanation of the phenomena of the iron sphere; and after many experiments to prove, that *the force of each particle of the galvanic wire on each particle of the needle varies inversely as the square of the distance*, and that the nature of the force is tangential, that is, such as would place a needle always at right angles to the direction of the wire, (facts more fully elicited by M. AMPÈRE's investigations,) he applied it to the construction of a globe which should exhibit the whole phenomena of terrestrial magnetism as due to the superficial action of galvanic currents. This idea was put to the test of experiment with the most satisfactory results. A wooden globe of 16 inches diameter was encircled by a series of coils of wire in circles representing the latitude lines of the actual globe or parallels to the earth's magnetic equator. When the two ends of the coils of wire were connected with the two poles of a galvanic battery, a state of magnetism was induced precisely resembling the state of things on the earth: and a small needle placed in any situation upon its surface assumed the dip and variation corresponding to the locality.

Thus Mr. BARLOW was the first to prove the existence of a force competent to produce all the phenomena of terrestrial magnetism, without the aid of any body usually called magnetic; and indeed it had been shewn by M. BIOT's laws, that no position of a single magnet, nor the arrangement of any number of such bodies within the globe, could cause an exhibition of the same phenomena, particularly as relates to the intensity of the needle's magnetism.

As far as the discovery of M. ØERSTED went, however, it did not appear how a system of electrical currents could have existence on the earth, without a particu-

\* Essay on Magnetic Attraction, 1820.

lar arrangement of metals, acids, and conductors. This difficulty was removed by a subsequent discovery of Professor SEEBECK, of Berlin, only inferior in importance to the first, that the mere application of heat to a circuit composed of two metals was competent to produce the same development of galvanic and magnetic effects as those of the pile. Thus if instead of the coil of conducting wire on the globe above described, each parallel were made complete in two metals, all the phenomena might be represented by the application of heat only. A still farther simplification has been made by Mr. STURGEON of Woolwich, who has produced all the effects of a compound metallic combination, with a rectangle of bismuth only, *unequally heated*: a fact according wonderfully with the galvanic plate, described in M. Becquerel's experiments, of a single metal acted on by saline solutions of irregular composition.

"M. SEEBECK's discovery brings us therefore," says Mr. BARLOW, "a step nearer to our object, by referring us to the sun as the great agent of all these phenomena, and indeed only one link seems wanted to connect together the chain, and thereby to reduce to simple and intelligent principles what has hitherto been considered amongst the most mysterious laws of nature."

Since the publication of Mr. BARLOW's paper, Mr. FARADAY has taken up the subject of *volta-electric* and *magneto-electric induction*, and although we have not a full account of his experiments, the notice of them in the report of the Royal Institution already prepares us for a train of highly curious results; indeed, the grand desideratum of converting magnetism into electricity seems in his skilful hands on the points of attainment.

"If two wires (A and B) be placed side by side, but not in contact, and a voltaic current be passed through A, there is instantly a current produced by induction in B, in the opposite direction. Although the principal current in A be continued, still the secondary current in B is not found to accompany it, for it ceases after the first moment; but when the principal current is stopped, then there is a second current produced in B, in the opposite direction to that of the first produced by the inductive action, or in the same direction as that of the principal current. These induced currents are so momentary that their effect on the galvanometer is scarcely sensible; but when they are passed through helices containing unmagnetised steel needles, they convert them into magnets.

If a wire connected at both extremities with a galvanometer be coiled, in the form of a helix, round a magnet, no current of electricity takes place in it. This is an experiment which has been made by various persons, hundreds of times, in the hope of evolving electricity from magnetism, and, as in other cases in which the wishes of the experimenter, and the facts, are opposed to each other, has given rise to very conflicting conclusions.—But if the magnet be withdrawn from or introduced into such a helix, a current of electricity is produced whilst the magnet is in motion, and is rendered evident by the deflection of the galvanometer. If a single wire be passed by a magnetic pole, a current of electricity is induced through it, which can be rendered sensible."

Thus is obtained the result so long sought after, *the conversion* of magnetism into electricity; whenever a metallic body moves near a magnet, so as to intersect the magnetic curves, electricity is evolved, according to very simple laws. Similar results have been obtained even with the magnetism of the earth; on these subjects Mr. FARADAY had recently read a paper before the Royal Society, and he intended (in February) bringing them forward experimentally at the evening meetings of the Royal Institution.

The induction of electricity by the momentary passage of a magnetic pole, so analogous to that of the induction of magnetism by a current of electric fluid, leads at once to the consideration of another branch of magnetic phenomena which originated with Mr. ARAGO, and has since been studied assiduously by Messrs. HERSCHEL, CHRISTIE, BARLOW, and STURGEON, and others, namely, the magnetic effects of metallic plates in rotation, with which we think should be classed, the practical methods of magnetising steel bars, by the motion of magnets over them.

That magnetism existed in brass had been pointed out by Mr. BARLOW in 1823, but the magnetic force in most metals except iron, nickel, and cobalt was far too feeble to be detected by the simple application of the most delicate needle. Mr. ARAGO judiciously applied the principle of the *magnetic momentum* generated by the rapid motion of discs of these metals, and demonstrated that all possessed magnetic energy in various degrees\*. The novel phenomenon of a magnetic needle rotating on its pivot by simply placing it above a revolving plate of copper, had something in it so fascinating, and presented so striking a similitude to the electro-magnetic rotations then familiar to philosophers, that for a while it was doubted whether or not the revolving plate possessed electric properties. Another mode of solving the problem was, that the copper plate, like all ferruginous bodies, actuated the needle through what is called *induced* magnetism by the influence of the earth, and that the needle was put into motion by a rapid succession of transient magnetic poles induced in the plate. When however it was found that light copper discs would of themselves rotate when suspended over a revolving horse-shoe, or other powerful magnet, it occurred that all the phenomena emanated from the action of the magnet employed, exciting transient polarity in the metals under examination.

Mr. STURGEON, from whose paper the foregoing facts are drawn, was from the want of an adequate hypothesis led to examine the distribution of magnetic polarity in metallic discs, by making them revolve or oscillate between the poles of a horse-shoe magnet, and trying the conditions of various parts of the plate by a small dipping needle. The number of vibrations performed by a thin copper disc under the influence of a magnet, were reduced even five-fold when compared with its free vibrations in air.

This subject is still under investigation, and will doubtless receive fresh elucidation from the able men engaged upon it: we have already found that magnetism is but another name for electricity, and shall soon know how to elicit it from every substance, and perhaps to draw benefits as important in mechanical as the polarity of the needle is in nautical science. What can be more wonderful than the prodigious mechanical force set in action by what appears a very inadequate cause,—the elector-magnet, an instrument now familiarly known, in which a coil of wire is wound round a horse-shoe of soft iron, and connected by its two extremities with two small plates of zinc and copper. One of these instruments, constructed by Mr. WALSH of Woolwich, was exhibited at the evening meetings of the Institution, which when the plates were dipped in weak acid, sustained a weight of between 300 and 400 pounds, though before the application of the voltaic power it did not support an ounce.

The last fact to be noted in the progress of electrical knowledge, is the production of sparks from the magnetic needle in Italy: Signor NOBILI's announcement has been confirmed by Mr. JAMES D. FORBES' experiments, before the Edinburgh Royal Society, in April, 1832. And the power of drawing sparks from the natural magnet is now established. All we know as yet of the procedure is that, it "rests upon the recent discoveries of our distinguished countryman Mr. FARADAY."

\* W. Sturgeon, Phil. Mag. April, 1832.

*Meteorological Register, kept at the Surgeon General's Office, Culcutta, for the Month of April, 1874.*

| Days of the Month. |        | Minimum Temperature observed at sunrise. |                     |                        | Maximum Temperature observed at 9h. 50m. |                    |                     | Max. Temp. and Dryness observed at 2h. 40m. |                        |       | Minimum Temperature observed at 4h. 0m. |                     |                     | Observations made at sunset. |       |                    | Observations in Calcutta, 1st, 2nd, 3rd, & 4th. |                     |                        |       |                    |      |      |     |      |      |      |      |      |      |
|--------------------|--------|--|---------------------|------------------------|--|--------------------|---------------------|---|------------------------|-------|---|---------------------|---------------------|------------------------------|-------|--------------------|---|---------------------|------------------------|-------|--------------------|------|------|-----|------|------|------|------|------|------|
|                    |        | Barometer reduced to 32°.                | Temper. of the air. | Depres. of M. B. Ther. | Wind.                                    | Aspect of the sky. | Barom. red. to 32°. | Temper. of the air.                         | Depres. of M. B. Ther. | Wind. | Aspect of the sky.                      | Barom. red. to 32°. | Temper. of the air. | Depres. of M. B. Ther.       | Wind. | Aspect of the sky. | Barom. red. to 32°.                             | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. |      |      |     |      |      |      |      |      |      |
| 1                  | 29.389 | 79.7                                     | 1.2                 | cm.                    | rn.                                      | 34.5               | 80.7                | 5.5   | s.                     | cu.   | 33.2                                    | 80.                 | 3.5                 | m.                           | cu.   | 30.7               | 81.5  | 2.1                 | m.                     | n.    | cu.                | 30.7 | 80.5 | 3.3 | s.   | w.   | cu.  | 1.23 | 1.45 |      |
| 2                  | 32.321 | 79.5                                     | 1.9                 | m.                     | e.                                       | 30.1               | 86.                 | 5.3   | m.                     | e.    | 32.5                                    | 85.                 | 3.5                 | m.                           | e.    | 32.8               | 81.   | 1.8                 | m.                     | cu.   | 32.7               | 82.0 | 2.8  | e.  | cu.  | 0.64 | 0.31 | 0.62 | 0.21 |      |
| 3                  | 35.7   | 79.7                                     | 1.5                 | do.                    | cy.                                      | 35.9               | 82.5                | 2.  | rn.                    | 34.1  | 84.3                                    | 3.3                 | s.                  | cu.                          | 35.7  | 82.                | 1.8   | s.                  | cu.                    | 35.7  | 82.                | 1.8  | s.   | cu. | 0.52 | 0.19 | 0.52 | 0.19 | 0.52 | 0.19 |
| 4                  | 41.7   | 79.                                      | 1.3                 | s.                     | e.                                       | 42.1               | 84.5                | 4.8   | s.                     | e.    | 41.3                                    | 83.5                | 3.8                 | s.                           | e.    | 43.4               | 81.5  | 2.3                 | s.                     | cu.   | 43.4               | 81.5 | 2.3  | s.  | cu.  | 0.51 | 0.82 | 0.51 | 0.82 |      |
| 5                  | 50.6   | 80.                                      | 1.5                 | s.                     | cu.                                      | 49.9               | 85.                 | 5.1   | do.                    | cu.   | 48.7                                    | 87.                 | 6.3                 | s.                           | e.    | 46.3               | 84.   | 4.3                 | s.                     | cu.   | 46.3               | 84.  | 4.3  | s.  | cu.  | 0.54 | 0.83 | 0.54 | 0.83 |      |
| 6                  | 56.4   | 80.                                      | 1.3                 | s.                     | w.                                       | 55.2               | 85.5                | 5.8   | s.                     | w.    | 54.8                                    | 87.                 | 2.8                 | s.                           | w.    | 56.8               | 84.   | 1.8                 | s.                     | w.    | 56.8               | 84.  | 1.8  | s.  | w.   | 0.56 | 0.92 | 0.56 | 0.92 |      |
| 7                  | 61.6   | 80.                                      | 1.3                 | s.                     | w.                                       | 60.1               | 84.                 | 3.8   | s.                     | cu.   | 60.5                                    | 80.7                | 2.2                 | do.                          | n.    | 61.3               | 78.7  | 1.8                 | do.                    | n.    | 61.3               | 78.7 | 1.8  | do. | n.   | 0.58 | 0.92 | 0.58 | 0.92 |      |
| 8                  | 58.0   | 77.                                      | 1.8                 | do.                    | rn.                                      | 55.9               | 87.5                | 2.6   | s.                     | e.    | 52.4                                    | 84.                 | 3.0                 | s.                           | e.    | 52.4               | 84.   | 3.0                 | s.                     | e.    | 52.4               | 84.  | 3.0  | s.  | e.   | 0.59 | 0.92 | 0.59 | 0.92 |      |
| 9                  | 55.1   | 77.                                      | 1.3                 | s.                     | e.                                       | 50.1               | 80.5                | 5.8   | s.                     | e.    | 52.3                                    | 80.5                | 8.3                 | do.                          | cu.   | 57.2               | 83.5  | 3.3                 | do.                    | cu.   | 57.2               | 83.5 | 3.3  | do. | cu.  | 0.60 | 0.20 | 0.60 | 0.20 |      |
| 10                 | 60.6   | 80.                                      | 1.5                 | do.                    | cu.                                      | 60.1               | 80.5                | 9.8   | w.                     | do.   | 52.3                                    | 80.5                | 8.3                 | do.                          | cu.   | 57.2               | 83.5  | 3.3                 | do.                    | cu.   | 57.2               | 83.5 | 3.3  | do. | cu.  | 0.61 | 0.20 | 0.61 | 0.20 |      |
| 11                 | 60.6   | 81.7                                     | 1.5                 | do.                    | cu.                                      | 55.7               | 90.5                | 9.8   | w.                     | do.   | 52.3                                    | 80.5                | 8.3                 | do.                          | cu.   | 57.2               | 83.5  | 3.3                 | do.                    | cu.   | 57.2               | 83.5 | 3.3  | do. | cu.  | 0.62 | 0.20 | 0.62 | 0.20 |      |
| 12                 | 50.8   | 81.                                      | 2.3                 | n.                     | w.                                       | 47.5               | 86.                 | 5.5   | w.                     | cu.   | 47.5                                    | 86.                 | 5.5                 | w.                           | cu.   | 47.5               | 86.   | 5.5                 | w.                     | cu.   | 47.5               | 86.  | 5.5  | w.  | cu.  | 0.63 | 0.20 | 0.63 | 0.20 |      |
| 13                 | 43.8   | 79.5                                     | 1.6                 | n.                     | e.                                       | 39.8               | 87.5                | 5.6   | n.                     | e.    | 39.8                                    | 87.5                | 5.6                 | n.                           | e.    | 39.8               | 87.5  | 5.6                 | n.                     | e.    | 39.8               | 87.5 | 5.6  | n.  | e.   | 0.64 | 0.20 | 0.64 | 0.20 |      |
| 14                 | 42.2   | 81.5                                     | 1.8                 | do.                    | cu.                                      | 36.7               | 90.5                | 10.6  | do.                    | cu.   | 36.7                                    | 90.5                | 10.6                | do.                          | cu.   | 36.7               | 90.5  | 10.6                | do.                    | cu.   | 36.7               | 90.5 | 10.6 | do. | cu.  | 0.65 | 0.20 | 0.65 | 0.20 |      |
| 15                 | 42.0   | 81.                                      | 1.8                 | do.                    | cu.                                      | 33.5               | 87.5                | 6.3   | do.                    | do.   | 33.5                                    | 87.5                | 6.3                 | do.                          | do.   | 33.5               | 87.5  | 6.3                 | do.                    | do.   | 33.5               | 87.5 | 6.3  | do. | do.  | 0.66 | 0.20 | 0.66 | 0.20 |      |
| 16                 | 41.1   | 79.7                                     | 1.8                 | do.                    | cy.                                      | 33.5               | 87.5                | 6.3   | do.                    | do.   | 33.5                                    | 87.5                | 6.3                 | do.                          | do.   | 33.5               | 87.5  | 6.3                 | do.                    | do.   | 33.5               | 87.5 | 6.3  | do. | do.  | 0.67 | 0.20 | 0.67 | 0.20 |      |
| 17                 | 39.4   | 81.                                      | 2.8                 | do.                    | cu.                                      | 33.5               | 87.5                | 6.3   | do.                    | do.   | 33.5                                    | 87.5                | 6.3                 | do.                          | do.   | 33.5               | 87.5  | 6.3                 | do.                    | do.   | 33.5               | 87.5 | 6.3  | do. | do.  | 0.68 | 0.20 | 0.68 | 0.20 |      |
| 18                 | 50.2   | 80.7                                     | 1.8                 | s.                     | e.                                       | 40.8               | 88.5                | 6.4   | s.                     | e.    | 40.8                                    | 88.5                | 6.4                 | s.                           | e.    | 40.8               | 88.5  | 6.4                 | s.                     | e.    | 40.8               | 88.5 | 6.4  | s.  | e.   | 0.69 | 0.20 | 0.69 | 0.20 |      |
| 19                 | 44.8   | 81.7                                     | 2.1                 | do.                    | cu.                                      | 42.1               | 81.                 | 2.6   | cm.                    | cu.   | 42.1                                    | 81.                 | 2.6                 | cm.                          | cu.   | 42.1               | 81.   | 2.6                 | cm.                    | cu.   | 42.1               | 81.  | 2.6  | cm. | cu.  | 0.70 | 0.20 | 0.70 | 0.20 |      |
| 20                 | 46.6   | 81.7                                     | 2.1                 | do.                    | cu.                                      | 42.1               | 81.                 | 2.6   | cm.                    | cu.   | 42.1                                    | 81.                 | 2.6                 | cm.                          | cu.   | 42.1               | 81.   | 2.6                 | cm.                    | cu.   | 42.1               | 81.  | 2.6  | cm. | cu.  | 0.71 | 0.20 | 0.71 | 0.20 |      |
| 21                 | 54.7   | 81.                                      | 1.8                 | s.                     | w.                                       | 51.0               | 88.7                | 7.7   | do.                    | cu.   | 51.0                                    | 88.7                | 7.7                 | do.                          | cu.   | 51.0               | 88.7  | 7.7                 | do.                    | cu.   | 51.0               | 88.7 | 7.7  | do. | cu.  | 0.72 | 0.20 | 0.72 | 0.20 |      |
| 22                 | 55.6   | 81.5                                     | 2.6                 | do.                    | cu.                                      | 51.0               | 88.7                | 7.7   | do.                    | cu.   | 51.0                                    | 88.7                | 7.7                 | do.                          | cu.   | 51.0               | 88.7  | 7.7                 | do.                    | cu.   | 51.0               | 88.7 | 7.7  | do. | cu.  | 0.73 | 0.20 | 0.73 | 0.20 |      |
| 23                 | 55.6   | 81.5                                     | 2.6                 | do.                    | cu.                                      | 51.0               | 88.7                | 7.7   | do.                    | cu.   | 51.0                                    | 88.7                | 7.7                 | do.                          | cu.   | 51.0               | 88.7  | 7.7                 | do.                    | cu.   | 51.0               | 88.7 | 7.7  | do. | cu.  | 0.74 | 0.20 | 0.74 | 0.20 |      |
| 24                 | 51.0   | 79.                                      | 1.5                 | m.                     | e.                                       | 44.1               | 88.                 | 7.2   | do.                    | cu.   | 44.1                                    | 88.                 | 7.2                 | do.                          | cu.   | 44.1               | 88.   | 7.2                 | do.                    | cu.   | 44.1               | 88.  | 7.2  | do. | cu.  | 0.75 | 0.20 | 0.75 | 0.20 |      |
| 25                 | 43.1   | 79.3                                     | 1.4                 | do.                    | cu.                                      | 38.6               | 89.                 | 7.9   | do.                    | cu.   | 38.6                                    | 89.                 | 7.9                 | do.                          | cu.   | 38.6               | 89.   | 7.9                 | do.                    | cu.   | 38.6               | 89.  | 7.9  | do. | cu.  | 0.76 | 0.20 | 0.76 | 0.20 |      |
| 26                 | 40.8   | 80.3                                     | 1.6                 | s.                     | e.                                       | 37.1               | 88.9                | 7.2   | s.                     | w.    | 37.1                                    | 88.9                | 7.2                 | s.                           | w.    | 37.1               | 88.9  | 7.2                 | s.                     | w.    | 37.1               | 88.9 | 7.2  | s.  | w.   | 0.77 | 0.20 | 0.77 | 0.20 |      |
| 27                 | 45.4   | 79.7                                     | 1.1                 | cm.                    | n.                                       | 47.6               | 81.7                | 6.1   | do.                    | cu.   | 47.6                                    | 81.7                | 6.1                 | do.                          | cu.   | 47.6               | 81.7  | 6.1                 | do.                    | cu.   | 47.6               | 81.7 | 6.1  | do. | cu.  | 0.78 | 0.20 | 0.78 | 0.20 |      |
| 28                 | 55.3   | 79.5                                     | 1.3                 | s.                     | e.                                       | 53.1               | 85.5                | 5.5   | s.                     | do.   | 53.1                                    | 85.5                | 5.5                 | s.                           | do.   | 53.1               | 85.5  | 5.5                 | s.                     | do.   | 53.1               | 85.5 | 5.5  | s.  | do.  | 0.79 | 0.20 | 0.79 | 0.20 |      |
| 29                 | 56.4   | 79.5                                     | 1.3                 | s.                     | e.                                       | 53.1               | 85.5                | 5.5   | s.                     | do.   | 53.1                                    | 85.5                | 5.5                 | s.                           | do.   | 53.1               | 85.5  | 5.5                 | s.                     | do.   | 53.1               | 85.5 | 5.5  | s.  | do.  | 0.80 | 0.20 | 0.80 | 0.20 |      |
| 30                 | 50.8   | 81.3                                     | 2.4                 | s.                     | w.                                       | 41.1               | 83.7                | 6.5   | s.                     | w.    | 41.1                                    | 83.7                | 6.5                 | s.                           | w.    | 41.1               | 83.7  | 6.5                 | s.                     | w.    | 41.1               | 83.7 | 6.5  | s.  | w.   | 0.81 | 0.20 | 0.81 | 0.20 |      |
| 31                 | 46.8   | 79.7                                     | 2.                  | n.                     | do.                                      | 41.2               | 90.                 | 7.3   | n.                     | w.    | 40.6                                    | 87.7                | 5.8                 | n.                           | do.   | 40.6               | 87.7  | 5.8                 | n.                     | do.   | 40.6               | 87.7 | 5.8  | n.  | do.  | 0.82 | 0.20 | 0.82 | 0.20 |      |
| Mean               | 29.408 | 80.0                                     | 1.8                 |                        |  | 44.0               | 86.5                | 5.9   |                        |       | 42.7                                    | 85.5                | 5.0                 |                              |       | 43.6               | 82.9  | 3.2                 |                        |       | 43.6               | 82.9 | 3.2  |     |      | 0.83 | 0.20 | 0.83 | 0.20 |      |

Abbreviations.

In the column "wind," small letters have been instead of capitals; *cu.* means *clouds*.

*rn.* rain, *cy.* cirrus, *st.* stratus, *cu.* cumulus, *sc.* cirro-stratus, *cc.* cirro-cumulus, *n.* nimbus.

In the column "aspect of the sky," *cy.* is *cloudy*; *cl.* clear; *sc.* clear.

Abbreviations. In the column "wind," small letters have been instead of capitals; *cm.* means calm; *rn.* rain; *cy.* cirrus; *cu.* cumulus; *sc.* cirro-stratus; *cs.* cirro-cumulus; *n.* nimbus.

In the column "aspect of the sky," *cy.* is cloudy; *cl.* clear;



# JOURNAL

OF

## THE ASIATIC SOCIETY.

No. 9.—September, 1832.

I.—*Analysis of the KAH-GYUR.* By H. H. Wilson, Sec. As. Society.  
(Continued from page 8.)

### SHER-CHIN.

AT a former meeting of the Society, a summary of the contents of the DUL-VÁ, or first part of the large Tibetan collection, the KAH-GYUR, derived from the more detailed catalogue of Mr. CSOMA DE KÖRÖS, was presented to the Society. Since that period Mr. CSOMA has completed the catalogue of the whole work, and I propose on the present occasion to offer an abstract of the information thence obtained.

### II.—THE SHER-CHIN.

The second portion of the KAH-GYUR is entitled the *Shes-rab kyi pha rol tu phyin pá*, or by contraction *Sher phyin*, pronounced *Sher-chin*. In Sanscrit *Aryá Bhagavatí Prajná Páramitá*, or simply *Prajná Páramitá*, the two first words implying the venerable goddess, epithets applied to *Prajná*, wisdom or understanding; also styled *Páramitá*, or that by the means of which life is traversed and emancipation obtained, from *Páram* beyond, and *Ita* gone; and which may be rendered therefore Transcendent or transcendental wisdom.

The Chinese explain it correctly, “le moyen de parvenir a l'autre rive par la science : parvenir a l'autre rive est une expression mystique pour indiquer—l'absorption du, contemplatif et sa delivrance finale.”—*Journal des Savans*, Mai, 1831.

This class consists of six different works, in twenty-one large volumes; of these, the first five all bear the same title *Aryá Bhagavatí Prajná Páramitá*, and are only discriminated by the titles expressing the number of stanzas which they contain. The sixth division is of a more miscellaneous character.

The first work, entitled the *Shes-rab kyi pha rol tu phyin pá—s'tong phrag Br. gya pá* (or *H. bum*), or in Sanscrit *Āryā Bhagavati Sata Sahasrikā Prajñā Pāramitā*, consists as the designation imports of 100,000 *ślokas* or stanzas. It occupies 12 volumes, divided into 75 books and 303 sections.

The second work is nothing more than an abridgement of the preceding, in which the number of stanzas is 25,000, whence its name the *Panchavinsati Sahasrikā*. It occupies 3 volumes.

The third work is also an abridgement of the first, in 18,000 stanzas, or *Asthalasā Sahasrikā*. It likewise occupies three volumes.

The fourth work in one volume is the *Dasa Sahasrikā*, an abridgement of the second work in the collection, in which the 25,000 stanzas are reduced to 10,000; and the fifth work is a final abridgement of the whole, in which the number of stanzas is brought down to 8,000, contained in one volume.

The twenty-first and last volume of this division of the *KAH-GYUR* is entitled *S'na-ts-hogs*, or the miscellany. It comprises 18 different treatises, all of the class of *Sūtras*\*, (original preceptive authorities,) and explanatory of the doctrines taught in the preceding volumes, in a summary form and commonly in verse.

As might be expected from their more compendious form, several of these are of more general currency than the original, and they may be regarded as the popular representations of the metaphysical speculations of Buddhism. Thus the fifth tract, entitled the *Vajrachhedikā*, the cutter of adamant, in which the true sense of the *Prajñā Pāramitā* is explained by ŚĀKYA to his disciple SUBHUTI in 18 leaves, is frequently met with in Tibet, in a detached form. The five last treatises are denominated from the *Bodhisatwas*, to whom they are addressed, the *Prajñā Pāramitā* of *Surya-gerbha*, *Chandra-gerbha*, *Samanti-bhadra*, *Vajrapāni*, and *Vajraketū*. In one of the number, a specimen of mysticism occurs. It is called the *Prajñā Pāramitā Sarva Tathāgata Ekakshari*, or the mono-literal transcendental wisdom of all the Buddhas, and refers the essence and origin of all things to the first letter of the alphabet, or A. For this being the first element of speech, all instruction is derived from it, all wisdom obtained, and it is hence to be regarded as the mother of the *Bodhisatwas*, the essential means of final liberation, and the substance of the *Prajñā Pāramitā*.

\* Mr. Hodgson says, *Sūtra* is often explained *Mūla* (root) *Grantha*, and *Buddha vachana*, or words of Buddha.—As. R. vol. xvi.

A careful examination of the original *Prajñā Pāramitā*, or a translation of one of the abridgements of it, is the only means of determining the real purport of the native doctrine of the Buddhas, as taught by ŚĀKYA. It is indeed urgently required, in order to save many eminent scholars from the unsatisfactory labour of endeavouring to compose a regular system out of the *disjecta membra* placed within their reach, by the study of inferior authorities or oral communication\*. It is to be hoped, therefore, that Mr. Csoma may be prevailed upon to undertake the task, however difficult and irksome it may prove, not only from the inherent obscurity of the subject, but the very desultory and vague manner in which it is treated by ŚĀKYA, or his disciples—a style of discussion which renders it impossible to give a satisfactory analysis of the contents of the *Sher-chin*.

Speaking generally, the volumes of this division contain the metaphysical and psychological doctrines of the Bauddhas, as taught by ŚĀKYA to his pupils, and to other Bodhisattvas and Buddhas. There are especially one hundred and eight leading topics (*Dharmas*), which with numerous subdivisions admit of argument, of affirmation and negation. Thus of aggregation or body, five predicates may be asserted—shape, perception, consciousness, faculty, and discrimination. The senses are said to be six—sight, hearing, smell, touch, taste, and understanding†; there are also six organs of sense, six objects, and eighteen regions. There are six elements, earth, water, fire, air, ether, and spirit, (or intellect‡.)

There are twelve concatenated causes of existence, whether of matter or spirit—1. ignorance; 2. faculty; 3. discrimination; 4. definite form; 5. sensation; 6. perception; 7. knowledge; 8. desire; 9. privation; 10. vitality; 11. birth; 12. old age and death. There are six transcendental virtues—1. charity; 2. gentleness; 3. patience; 4. vigorous application; 5. meditation; 6. wisdom. To these four others are sometimes added—method, salutation or prayer, fortitude, and prescience.

\* Mons. REMUSAT states in a note on his Review of Mr. Hodgson's Sketch of Buddhism, in the Transactions of the R. A. Society (*Journal des Savans*), that subsequently to its publication, "il a paru dans le *Journal Asiatique*, et dans les *Mémoires de l'Académie de Petersbourg*, plusieurs morceaux où l'existence d'un Dieu supreme, dans le Buddhism est discutée contradictoirement."

† This is contrary to the statements hitherto published: disputed points between the Nyayikas and Bauddhas being the number of the organs, reckoned by the former, six, including mind, and by the latter, five, excluding mind; and the including of the *āhās* as a distinct element, which the Bauddhas do not recognise.

Of the great dogma of Buddhism, the determination of *Sunyatá*, emptiness or unreality, eighteen varieties are enumerated.

The specification of these varieties however does not furnish a very precise notion of what is meant, and it is not easy to understand what is intended by the doctrine that "nothing is," especially when associated with the eternity of matter, and even of an eternal first cause. In one point of view, it is a mere logical subtlety. / All things are liable to change, the only state of which eternal identity can be predicated, is non-existence—nothingness. That which never is can never perish, and is therefore the only one enduring invariable principle in creation.

*Sunyatá* may also be regarded in a figurative sense, as the illusory nature of all corporeal and mundane existence.

These and the other speculations contained in these volumes are said to have been taught by *SÁKYA* in his 53rd year, 16 years after he had attained the degree of a Buddha, when he resided on the mountain of *Gridhra-kúta*, near *Raja Griha*. In some cases he delivers his instruction direct; in others he replies to questions put to him by propositions, which his disciples discuss, and thus elicit the answer for themselves.

The first compiler of the *Prajná Páramitá* was *KASYAPA*, the successor of *SÁKYA* in the hierarchy. The work was translated in the ninth century by the Indian pundits *JINAMITRA* and *SURENDRA BODHI*, and the Tibetan interpreter *YE-SHES-DE*. As I had occasion to notice, on a former occasion, the Society is in possession of the Sanscrit original of the *Sata Sahasriká*, or work in 100,000 stanzas; one entire copy and three sections of a second in the *Lan-ja* character; and one entire set in *Devanagari*, in five large volumes.

### III.—*PHAL-CH'HEN*.

The third division of the *KAH-GYUR* is called in Tibetan *Sangsgyas phál po ch'he*, or by contraction *Phál ch'hen*. In Sanscrit *Buddha avatamsaka*, the crest or diadem of the Buddhas.

In the general account of the *KAH-GYUR*, the term is given *Buddhavata-Sanga*, association of Buddhas, but the present is probably the correcter reading.

It is of much less extent than either of the preceding portions, containing only six volumes of a connected series, which detail in 45 sections legends relating to different *Tathágatas* and *Bodhisattvas*, and a description of the different regions of the universe, agreeably to *Buddha* cosmology, interspersed with recommendations of the moral practices of the system. These legends and lessons are narrated chiefly by

SÁKŸA, either on the summit of mount *Meru*, or in the *Tushita* heaven ; and accordingly are intended only for the benefit of the highest order of aspirants to the perfection of a Buddha

This work is also termed a *Mahá Vaipulya Sātra* or Scripture of great extent : it was translated in the ninth century by the pundit SURENDRA BODHI and LOTSAYA BAIROTSANA RAKSHITA.

#### IV.—KON-TSEGS.

The next division, although of no greater extent, is more diversified in its character, and contains in six volumes 41 different treatises : the whole collection is entitled *D. kon M. ch'hog Br. tsegs pá*, or simply *Kon-tsegs*. In Sanscrit *Retna-kūta*, the jewel peak, or pile of precious things. These precious things are the instructions of SÁKŸA, on a variety of moral subjects, delivered by him on the mountain *Grūthra-kūta* to his disciples. Many of them are in the form of dialogues, and more are in the shape of a reply to a question put by one of the disciples. One of the inquirers is the Hindu sage VYÁSA, who is enlightened by SÁKŸA on the topic of charity and alms-giving. Others are of all descriptions, from a Bodhisatwa to a young girl. The topics are various, generally moral, as in the first article on the three obligations ; the eighth on the ten virtues : sometimes legendary, as the 5th, 6th, and 12th, which give an account of the regions of the Buddhas, *Amitábha* and *Akshobhya*, and the Bodhisatwa *Manjū Sri*. Treatise four is upon the interpretation of dreams. No. 13 describes the meeting of SÁKŸA and his father SUDDHODANA, after the former had become a Buddha ; and in number 20, SÁKŸA explains to his disciple UPÁLI the order in which the chapters of the *DUL-VA* are to be arranged.

The translations of the *Kon-tsegs* are regarded as the work of the ninth century, by the pundits JINAMITRA, SURENDRA BODHI, DANASILA, and others, and the Tibetan interpreters YE-SHES-DE, and D. PUL ; Br. TSEGS.

#### V.—DO.

The next portion of the *KAH-GYUR* is entitled *M. Do-de* ; Sans. *Sūtrantā*, or simply, *M. Do Sūtra*, a term implying properly aphorism or rule, but here applied to a collection of treatises considered as of an authoritative, preceptive, or scriptural character. According to one classification of the *KAH-GYUR*, the *Do* class comprehends all the portions of the entire collection, except the *Gyut*, the last and *Tāntrika* class ; but in the present instance, as a distinct division, it comprises 251 different treatises, collected in 30 volumes.

They are all supposed to have proceeded originally from SÁKŸA, and to have been committed to writing shortly after his death by his disciple

ANANDA. The first volume *B. skal*, *B. zang*, or *S. Bhadra Kalpika*, the age of happiness, is called also a *Mahā-yāna Sūtra*, or a great chariot precept: the phrase which is commonly used in Buddha literature to denote a scripture of the first order, the metaphor implying that such works act as conveyances to bear the spirit beyond the bounds of existence.

The principal subject of this work is the enumeration both in prose and verse of a thousand Buddhas, of whom four have existed, the rest are yet to come. The circumstances related of each of these are classed under 15 heads, or—1. his name; 2. the place of his nativity; 3. his tribe; 4. the extent to which the radiance emanating from him proceeds; 5. his father; 6. his mother; 7. his son; 8. his attendants; 9. the most intelligent of his disciples; 10. the one amongst his disciples best versed in working miracles; 11. the number of his disciples collected on any particular occasion; 12. the duration of his life; 13. the period during which his doctrine prevails; 14. the relics remaining of him; 15. the shrines built for their reception. About 300 leaves are occupied with these details; they are preceded by 150 on the general perfections of a Buddha, and are followed by about 100, describing the first step taken by the Buddhas particularised to attain divine perfection. The work is supposed to have been repeated by SÁKYA in reply to the questions of a *Bodhisatwa*, and in the presence of a large concourse of followers of both sexes, gods, demons, Bodhisatwas, and Buddhas, in a grove between Sravasti and Vaisali.

In the enumeration of the Buddhas anterior to SÁKYA in this volume, it is worthy of remark, that only three are specified, or KRAKUCHHANDA, KANAKA, and KASYAPA. SÁKYA is the fourth. It would seem from this, that the existence of the three first of other lists VIPASYI, SIKHI, and VISWABHU' was not universally recognised in Tibet, any more than in Ceylon or to the eastward.

According to Mr. Schmidt, they do not occur in the Buddhist writings of the Mongols, but this seems doubtful, and Mons. REMUSAT states that they are specified in Chinese works.

The second volume of the *Do* class is chiefly occupied with the *Lalitā Vistāra*, or the account of SÁKYA, a piece of autobiography, related at the request of the gods by the sage himself. It is unnecessary to advert to it more particularly, as it furnished many of the details read at the last meeting on the subject of SÁKYA's life and actions. It is one of HODGSON's nine *Dhermas*.

The volume contains also three other short works, yet nevertheless styled *Mahā-yāna Sūtras*—1. *Arya Manjúsri vikrīdita*; 2. *Arya Man-*

*jásri vikurvána* ; 3. *Buddha kshetra nirdésa*. The two first relate to the actions and past lives of MANJU' SRI', a Bodhisatwa of some repute, who is the chief interlocutor in them with SÁKYA. The third is an account of the virtues of the place of Buddha's abode. These tracts contain various metaphysical discussions on the nature of life and spirit.

The third volume contains two works. The abridged title of the first may be *Bhagavan jnyána retna*, the jewel of the holy wisdom of Buddha. In this the omniscience of SÁKYA is eulogised and illustrated, first by his disciple GANG-ro, in a course of instruction given to a pious householder at a fabulous city called 'Excellent Virtue,' and afterwards by the *Nágas*. SÁKYA himself gives proofs of his power, as well as explanations of his doctrines, to both his new and old disciples.

The second work *Sarva Buddha jnyána áloka alankára*, the ornament of the light of knowledge of all the Buddhas, originated in a question put by MANJU' SRI' to SÁKYA, as to the meaning of the phrase, There is no beginning nor end to a *Tathágata* ; or in other words, a Buddha is subject to neither life nor death. SÁKYA in reply maintains argumentatively the superiority and imperishableness of all the Buddhas.

The fourth volume comprises five different works of comparatively small extent and little importance ; the two first are explanations of the doctrines delivered by SÁKYA to his disciples. The third contains a dialogue between SÁKYA and a little child found in a deserted house, and whom SÁKYA instructs in the usual topics. In the fourth, a Bodhisatwa describes the different regions of the Buddhas ; and the last, entitled 'the eight *Mandalas*,' contains little more than a recommendation to make these *Mandalas* or diagrams, as the means of securing prosperity ; a rite which belongs to the mystical rather than the metaphysical class of Bauddha notions.

The fifth volume comprises three different works. In the first, the *Sandhi nirmochana*, or resolution of combinations, an assemblage of Bodhisatwas is described ; several of whom propose subjects to SÁKYA, on which he expatiates.

Thus in the ninth chapter, SÁKYA at the request of AVA LOKITESWARA explains the ten *bhumis* or stages of perfectibility of a Bodhisatwa and Buddha ; and in the 10th, SÁKYA expounds to MANJU' SRI' the meaning of the term *Dherma káya*, the body or substance of righteousness. The second treatise, the *Lankavatára*, contains the doctrines taught by SÁKYA to a prince of *Lanka* ; and the third explains the meaning of the term Bodhisatwa given by SÁKYA to MANJU' SRI' on the hill *Gaya Sirsha*, whence it is called the *Gaya Sirsha Mahá-yána Súra*.

The sixth volume has three treatises. The first discusses the nature of life and the soul : the second is of mixed character, being as much legendary as philosophical ; it is termed *Mahā kuruna pundarīka*, and describes the approaching death of SĀKYA, and the conversations that took place between him and his disciples or the gods.

Thus on BRAHMA'S coming to condole with him, SĀKYA asks him who was the creator of all things, and whether he had any hand in creation. BRAHMA declares that he had none, and in turn inquires the birth of SĀKYA. The sage replies, that creation depends upon the acts of created beings ; that is, as long as retributive justice is rendered necessary by the weakness or vices of existent beings, they must continue to be born and die, and the world consequently to endure. He adds also, that the whole is illusion, there is no reality, all is *Suṅyatā*, or emptiness ; he then dismisses BRAHMA, desiring him to take care of the world on his behalf.

SĀKYA then gives instructions to his pupils ANANDA and KASYĀPA, as to the dissemination and compilation of his doctrines, and desires them in communicating his oral lessons, to use this formula, " I myself heard this, at such a time when Choim-dan-das (SĀKYA) lectured at such or such a place, when his auditors were such or such persons, all of whom when the discourse was over rejoiced greatly, and concurred in his doctrines." The third treatise bears the same name *Karunā pundarīka*, and relates to the same subjects.

The seventh volume contains six different works. In the first, MAITREYA and MANJU' ŚRĪ are introduced, discoursing on the marvellous perfection of SĀKYA, and the six great or transcendental virtues, charity, morality, patience, diligence, deep meditation, and clearness of intellect.

Other disciples appear in the work, of whom SĀKYA foretels the estimation in which they will be held. He also describes the conduct, and relates the lives of former TATHĀGATAS. The work is considered of high value, and is called *Saḍ Ḍherma Pundarīka*, the lotus of the piety of the holy. The other works in this volume are of a similar character. The fourth, the *Karanda vyākha*, is held in high veneration by the Tibetans, containing many eulogies by SĀKYA on CHENRE'SIK VĀNGCHUUK, their patron saint.

The ninth volume in like manner contains seven different works, and all to the same purpose. The two first were delivered by SĀKYA when on the point of death. The third or fourth, although ascribed originally to SĀKYA, are stated to have been rendered from Chinese



into Tibetan. The ninth volume contains six, and the tenth, seven different treatises.

Each of the succeeding volumes is similarly distributed amongst a greater or smaller number of different works. Thus, the 15th contains nineteen tracts, the 16th, eighteen, and the 26th, thirty-three. They are all of too similar a character to need particularization. Each is a lecture on some topic of Bauddha belief or practice, delivered by SÁKYA, at the request of some of his followers, or in reply to their inquiries. A few particulars of some of them may be noticed.

In the 13th volume and 14th article is narrated a dialogue between SÁKYA and an old woman at *Brij*. She puts many philosophical enquiries, to the astonishment of SÁKYA's pupil KUN-GAN-OO, on which SÁKYA tells him that she had been his mother in former ages for five hundred generations.

The 11th number of the 15th volume, the *Chandrottara dārikā Vyākaraṇa*, contains a prophecy, that a girl named CHANDROTTARĀ and one of his followers shall become a Buddha ; there are similar predictions of other persons in this volume.

In the *Lokana Samana Avatāra*, the 19th article, in the same volume, SÁKYA explains to MANJU' ŚRĪ, his spiritual son, the considerations which induce the Buddhas to conform their practices to the conceptions of mankind.

The 19th volume commences with the *Dherma Saṅgīti*, or treatise on moral merit : in this, the different virtues are enumerated, and an account given of the advantages to be derived from their exercise. A discussion is also detailed between two Bodhisatwas on the nature of the *Tathāgatas* or Buddhas, and in what sense the description of their birth, life, and death is to be received.

Most of the treatises in the 20th volume are intended for the benefit of the Bodhisatwas, and shew them by what moral and virtuous observances they may soonest attain the perfection and degree of a *Buddha*.

The first article in the 21st volume is entitled *Buddha nāma sahasra pāṇcha, suta chatūr, tri panchasat*, and is, as the name implies, the enumeration of 5,453 epithets of a Buddha or *Tathāgata*, each being descriptive of some fancied or real excellence, and being accompanied with a reverential formula. Thus,

I adore the *Tathāgata*, the universally radiant sun.

I adore the *Tathāgata*, the moral wisdom.

I adore the *Tathāgata*, the chief lamp of all the regions of space—and so on, for 137 leaves.

The second book in the 22nd volume, entitled *Achryuta Rāja*, gives an account of the periods of time prevailing in the different *Loka-dhātus*, or regions of different Buddhas.

The region of *SÁKYA* is the *Sahaloka dhātu*, the world of mortals under the viceregal supremacy of *BRAHMÁ*. In the same volume occurs the *Sapta Buddhaka Sūtra*, in which the seven Buddhas *VIPASYI* and the rest, at the solicitation of a Bodhisatwa, appear and communicate *Mantras* severally for averting evil. Three other tracts are successively devoted to eight, ten, and twelve Buddhas, but these are the holy personages of the region, and have no connexion with *SÁKYA* and his direct predecessors.

The twentieth work, in the 22nd volume, commences the *Saddherma Smṛityupasthāna*, or the influence of recollection over the discharge of true virtue. The work is continued through the whole of the 23rd and 24th volumes, and the greater part of the 25th, and may be considered as the moral code of *SÁKYA*. In this he describes the ten virtuous and ten vicious acts, and their consequences; the different degrees of transmigration; the scale of rewards and punishments; the division of heaven and hell; as well as the suffering experienced in this world; and illustrates his subject by numerous legendary tales. These volumes contain little speculative matter, and belong to the external or practical portion of the Bauddha doctrines. The last portion of the 25th volume contains, amongst other treatises, two belonging to the *Esoteric* doctrine—on *Sūnyatā* and *Mahā Sūnyatā*, emptiness and great emptiness, or the total unreality of material existence.

The 1st article in the 26th volume is an account of the life and actions of *SÁKYA*, and of the origin of the *SÁKYA* race. The details agree generally with those in the 3rd volume of the *DUL-VA*, and in the 2nd of the *Do* class, or *Lulita Vistāra*.

The 29th volume is occupied with four tracts, to three of which the term *Avadāna* is applied: they are of a legendary character: thus, the *Suhārika Avadāna* narrates the story of a divinity of one of the inferior heavens, named *Suhārika*, foreseeing that he is to become a hog in his next migration; his anticipated degradation plunges him into great distress, when he is advised by *INDRA* to have recourse to *SÁKYA*: he does so, and upon his death, not only escapes his threatened humiliation, but is elevated to a higher heaven, or that of *Tushita*.

The 30th volume contains 25 treatises, most of them legendary; the first five are in commendation of charity, the 11th is a narrative of *SÁRD'ULANÁSA*, the son of *TRISANKU*, a former chief of the *Sūdra* race, who by his talents obtained the daughter of a celebrated Brah-

man for his wife. This story is related in justification of SÁKYA's disciple and successor ANANDA, who married a girl of the *Súdra* caste. The tract contains an enumeration of castes and citations of several Hindú works. In the 23rd and 24th, the *Surya* and *Chandra Sūtras*, the sun and moon, apply to SÁKYA when seized by RÁHU, and are liberated from the demon at the command of the sage.

Two or three of these works are described as translated into Tibetan from Chinese, but with these exceptions they are rendered professedly from Sanscrit, and the names of the pundits and translators are given. They are much the same as those met within the *Dul-wa* class, or JINAMITRA, SURENDRA BODHI, DÁNA-SÍLA, PRAJNYÁVERMA, MUNIVERMA, &c. Few names of the *Lotsawas* or Tibetan interpreters are given; the chief is YE-SUES-DE, the translator of the *Lalita Vistára* and other principal articles in this class.

The *M. Do* class of the KAH-GYUR may be considered as that part of the course of Buddhist scriptures which is especially addressed to the lay votaries of this faith. It is not like the *Dul-wa*, intended for the guidance of the priests, nor is it like the *Sher-chin*, addressed to the philosophers, whilst it is also distinguished from the last great division of the *Kah-gyur*, by being free, with one or two slight exceptions, from any taint of mysticism. Although some of the treatises are of a speculative and metaphysical tendency, yet by far the greater number have a more practical bearing, and either in the legends they narrate or the lessons they convey, are evidently composed to enforce belief in SÁKYA, and consequent diligent practice of those virtues which it was the end of his mission to inculcate.

Several of the works contained in this collection belong to the *Nava Dherma*, or nine Dhermas, mentioned by Mr. HOBGSON, as objects of adoration, as well as high authorities in Nepal; such are the *Lalita vistára*, *Lankavatúra*, and *Sat Dherma Pundaríka*.

## VI.—MYANG DAS.

The smallest division of the KAH-GYUR is the *Mya-nan-las-das-pá*, or *Myang Das*: in Sanscrit the *Maha-parinirvána*, or simply *Nirvána Sūtra*. It is confined to two volumes, which give an account of the concluding scene of SÁKYA's life; his *Nirvána* or attainment of that state of spiritual quiescence which constitutes the *summum bonum* of the Buddhists. SÁKYA's death took place in Asam or *Kusa*. The possession of his relics was disputed by several of the cities and princes of India, and finally distributed amongst them. Stately *cháityas* or mausolea were erected for their reception.

## VII.—GYUR.

The seventh and last portion of the *KAH-GYUR* is of a very different description from either of the preceding, constituting an extensive collection of works on mystical worship, corresponding to the *Tāntrika* system of the Hindús, from which it is probably derived. The works are also of a more modern date, and less legitimately *Bauddha* character. The series consists of 22 volumes, each containing a number of small tracts. Most of them as usual are ascribed to *SÁKYA*.

The first volume contains 14 works, the first of which is an enumeration of the names of *MANJU'SRI*, a person who was very possibly concerned in grafting *Tantra* rites on Buddhist speculations. The third work is called the *Paramádibuddha uddhrita Sri Kāla Chakra*, a *Tantra* delivered by *SÁKYA*, at the request of *DA-ZANG*, a king of *Shambhala*, a fabulous city in the north; but the original is said to have proceeded from the first Supreme Buddha. It was introduced from the north, it is said, into India, in the 10th century, and into Tibet, in the 11th. How this is reconcileable with its being delivered by *SÁKYA* does not appear. Its modern date is unquestionable, as it makes mention of *Mekka*, and describes, in the form of a prophecy, it is true, the rise, progress, and decline of the Mohammedan religion. The work contains a variety of details in cosmography, astronomy, and chronology.

The second volume contains four works, the *Laghu-samvara*, the *Abhidhāna*, the *Samvara*, and *Vajra Daka*, in which the worship of certain spirits, as *HERUKA*, *SAMVARA*, and *VAJRA-DAKA*, with that of the female sprites and witches of the *Tantras*, the *YOGI'NIS* and *DÁKINIS*, is enjoined, and the *Mantras*, or mystical formulæ for invoking them, communicated. These different beings are considered equal to the Buddhas in power and sanctity by some classes of Buddhists.

The third volume has also four works of similar purport. In the first the *Heruka Anubhūta*, or appearance of *HERU'KA* the speaker, is *VAJRASATWA*, also styled *SAMVARA* and *BIAGAVÁN*, who, in answer to the questions of *VÁRÁHI'*, a goddess, explains her origin, her names, the import of the male and female symbols (*Linga* and *Bhaga*), the mystical power of different letters, illusion and union by *YOGA* with the deity: this and the other tracts also describe the different divinities worshipped, the *mandalas* or diagrams to be formed, and the *Mantras* to be repeated. The *Mantras* are also given, that of *Vajra-várāhī* commences "*Om Nama, goddess VAJRA-VÁRÁHI', holy and invincible mother of the three worlds. Great goddess of all wisdom,*

the remover of terror from all created beings." This *Mantra* is reputed to be of peculiar sanctity and efficacy.

The first article of the fifth volume is the *Sri-chanda Mahároshana Tantra*. In this the *Bhagaván VAJRA-SATWA* instructs the *BHAGAVATI' PRAJNYÁ PÁRAMITÁ* how to worship the wrathful deity called *CHANDA MAHÁROSHÁNA*, and in what manner a person may be initiated into the same knowledge by his spiritual guide. There are also speculations on the nature of body and spirit, and the means of re-uniting the human with the divine spiritual essence.

The first article of the sixth volume describes the subjugation of *NILAMBARA-DHARA*, *VAJRAPÁNI* and *INDRA*, by *SÁKYA*. In the second, the *Mantras* of several Hindú gods are given, or *Om BRAHMÁ—Om VISHNU—Om* salutation to *RU'DRA—Om KÁRTIKEYA—Om GANAPATI—Om* salutation to *INDRA—Om MAHÁKÁLA—Om* salutation to *BRAHMÁ*, and the like. In the fourth, especial injunctions are given to the novice, to persevere; the advantages of which are illustrated by the adage familiar to most nations, "In time a large stone is hollowed by small drops of water." "*Gutta cavat lapidem non vi sed sæpe cadendo.*" In this also *Mantras* or incantations are given for procuring abundance, curing disease, overpowering an enemy, and the like.

The first and second tracts in the seventh volume are styled *Krishna Yamári*, and *Yamári Krishna Karma Sarva Chakra Siddhahara*, the black foe of *YAMAR*, and the wheel of the black foe of *YAMA* or death, for accomplishing all acts. The fourth is the *Rakta Yamári Tantra*, or of the red foe of death. The third is the *Vajra mahá Bhairava Tantra*, and fifth, *Bhagaván Ekaajatá*, the god with the braid of hair: all, indications of close alliance with the followers of *SIVA*.

In the ninth volume, the sixth article is the *Mahá Vairochana Abhisambodhi*, a work of some extent, and sometimes regarded as a *Sútra*. It is ascribed to the Bodhisatwa *VAIROCHANA*, and was delivered by him at the request of *VAJRAPÁNI*. The chief interest attaching to this work arises from its containing the passage published in Europe in 1722, and most egregiously mistranslated by European scholars, as described in a former number of the Journal.

The tenth volume contains some treatises that seem scarcely to belong properly to this division; they contain prayers ascribed to different *Tathágatas* for the welfare of all animal beings, and repeated by *SÁKYA* at the request of *MANJU' SRÍ*. There are indeed many such tracts in the collection, some of which are met with in the other divisions, as the 4th and 8th of the 11th volume, the *Vipula pravesa*,

which occurred previously in the 2nd volume of the *DUL-VA*, and the *Sapta Buddhastava*, short prayers or *Mantras* attributed to each of the seven Buddhas which had a place in the 22nd volume of the *Do* class.

The fifteenth article in the 11th volume is one of the numerous proofs afforded by the catalogue of the intimate connexion of *MANJU' SRI'* with this part of the Buddhist ritual. It is styled *Aryā Manjā Sri Mūla Tantra*, the primary *Tantra* of the holy *MANJU' SRI'*. It is described as delivered by *SĀKYA* in the highest heaven, in the course of a conversation with *MANJU' SRI'* in the presence of the assembled Bodhisatwas and gods. Besides descriptions of *Mandalas*, and of various ceremonies, accompanied with numerous *Mantras*, it contains a system of astrology, an account of the planets and lunar constellations, of lucky and unlucky periods, and the characters of men born under different planetary combinations. *SĀKYA* in this part of the work predicts the birth of some illustrious characters in Indian literature or history, as *PĀNINI* and *CHANDRAGUPTA*; also of some eminent personages in his own faith, as *NĀGĀRJUNA* and *ARYA SANGA*, entitled by Mr. *CSOMA*, the Aristotle and Plato of Buddhism, and said by him to be the teachers of comparatively rational systems, speculative or practical, in the *Madhyāmika* and *Yogācharya* schools, of which they were severally the founders. *NĀGĀRJUNA* is a person who enjoys a very extensive but rather unintelligible celebrity in Hindustan. In the south of India, he is the reputed author of works on alchemical medicine, and in the introduction to the almanacks of Benares, he is commonly mentioned as the institutor of a *Sūka* or era yet to come, the last of the *Kali* age. Nothing else is known of him to the Hindús. According to the Buddhists he flourished four centuries after *SĀKYA*, in the south of India, and lived 600 years, traditions evidently connected with those of the peninsula. *ARYA SANGA*, according to Mr. *CSOMA*, lived in the 6th or 7th century after Christ.

This *Tantra* is held in high estimation by Tibetan writers, and contains a number of interesting particulars relative to the princes of India, who fostered or who persecuted Buddhism. It was translated by order of a Raja of Tibet, named *CHANG-CHU-BHOT*, at Tholing, in Gu-gé above Gerhwal and Kamaon, in the 11th century, by *KUMĀRA KALASA PUNDIT*, and the *GELONG, SĀKYA LO-GROS*.

The 12th volume contains two works of the same name and substance, but differing in their source; one being translated from Chinese and the other from Sanscrit. The Tibetan title is, *Dehi shing kim kwang med jwahi shing wang kyang*. The Sanscrit, *Aryā Suverna prabhāsa*

*Uttama Sūtra Indra Rājā nāma Mahāyāna Sūtra*, or the great holy *Yāna Sūtra*, the prince of the best of *Sūtras*, resplendent as the radiance of gold. This is one of the nine *Dhermas* of the Nepalese, and is very popular with all Buddhists. It contains a course of dogmatic instruction delivered by ŚĀKYA at *Grīdhra-kuta*, to his disciples and hearers, including the goddesses SARASWATI and LAKSHMI, and the four kings of Mount *Meru*, VAISRAVANA, DHṚTARĀSHITRA, VIRU'DHAKA, and VIRU'PĀKSHA.

The 13th volume contains 71 different works: many of them are but of small extent; some of them not more than two or three verses, the greater number being *Dhāraṇīs*, short incantations, or prayers of supposed protective efficacy, and not unfrequently carried as amulets about the person. Thus the 25th article, the *Aparājita Dhāraṇī*, which occupies about eight leaves, is a collection of formulæ addressed to the different Buddhas, which are preservatives against thieves, water, fire, poison, weapons, foes, famine, disease, lightning, sudden death, earthquakes, meteors, princes, evil spirits, and gods. Articles 28, 29, and 30 are *Dhāraṇīs* for the cure of fever, ophthalmia, and hæmorrhoids, whilst they are preceded by the *Sarva roga prasamīti*, No. 27 a cure for every malady. Some of these are ceremonial, to be used on circumambulating or consecrating a temple or mausoleum. In 42, is a *Dhāraṇī* for the augmentation of the understanding, *Prajñā verdhani*; this occupies but one page. The chief secret lies in the repetition of the *Mantra*, *Namo retna trayāya, Namo aryū Avalokiteswarāya, Bodhisatvāya, Mahā Satvāya Mahā Karuṇikāya*, "Salutation to the Three Holies. Salutation to the venerable Bodhisatwa, the purified and compassionate *Avalokiteswara*." No. 65 is a *Dhāraṇī* of two verses. No. 71 is a great *Dhāraṇī*, *Mahā Dhāraṇī*, delivered by ŚĀKYA to his disciple ANANDA, as a defence against all sorts of evils. These works are mostly ascribed to the same translators, as those of the large and more standard works; but Mr. Csoma thinks they had no part in these translations, the subjects being so dissimilar, and it being universally admitted by Tibetan writers, that the princes of the 9th and succeeding centuries discouraged the promulgation of *Tāntrika* works.

The 14th volume contains 53 works of a similar character in general as the preceding. From No. 3 to 10, they are lists of the names, 108 in number (like those of SIVA), of different characters, in the Buddhist mythology, or *Avalokiteswara, Matreya, Akāsa-gerbha, Sāmanta-bhadra, Vajrapāṇi, Mañjū Śrī, Sarvavarana, Viṣkambhi, Kṣhetra-gerbha*. No. 15 is called the *Mahāmegha*, the great cloud, being the name of a Buddha. In this a rather unusual office is assigned to

the *Nāgas*, or serpents, the charge of the rains, which they are made to promise they will send down in due season, in *Jambudwīpa*, or India. Nos. 18 and 19 are the *Mahā Ganapati Tantra* and *Ganapati Hridaya*, and describe the worship of GANESA, and the prayers sacred to him. Works with similar titles are not uncommon in Hindustan. The first was introduced into Tibet in the 11th century. No. 25 furnishes another analogy in nomenclature, being the *Devi Mahākālī Dhāraṇī*. This goddess, however, is called the sister and wife of YAMA, the mother of MĀRA or Love, and queen of the region *Kāmarūpa*. She is described as visiting SĀKYA, and receiving instructions and *Mantras* from him.

There are some other tracts on the same subject. Towards the end of the volume are several *Dhāraṇīs*, of which the hero is the Bodhisatwa AVALOKITESWARA or CHEN-RE-SIK, who is reputed to be the particular patron and tutelary divinity of Tibet. The last numbers are dedicated to the goddess TĀRĀ, the mother of all the *Tathāgatas*, and origin of many things; her names (108) are enumerated, and worship described, and *Mantras* addressed to her repeated.

The fifteenth volume is chiefly devoted to the *Tāntrika* worship of AMOGHAPĀSA and the goddesses SARASWATI and MAHĀSRĪ. One article, the last, entitled *Bhuta damana*, treats on the means of bringing *Bhuts* or imps, ghosts and goblins, under human controul. Part of the process is the use of the sundry gesticulations known in the Hindú system by the term *Mudrá*.

The 18th volume contains but one work, the *Bhagavatī Aryā Tārā Mūla Kalpa*:—a detailed description of the powers of TĀRĀ the goddess, the incantations addressed to her, and mode of offering her worship. It is attributed to SĀKYA, and was revealed by him to his disciples, when AVALOKITA was sent to him by AMITĀBHĀ from the *Sukhāvati* region.

In the 19th volume, the two first works are the *Dhāraṇīs* of MANIBHADRA, the *Yaksha*, and son of KUYERA. The *Mantra* of this personage is *Namo Retna trayāya, Namō Manibhadrāya Mahāyakṣa Senapatayē*. Salutation to the Holy Three—salutation to MANIBHADRA, general of the *Yaksha* host. The 12th article, *Sarva Maṇḍala sāmānya Vidhāna*, or general ritual for all *Mandalas*, is a copious account of the figures of these diagrams, mode of making them, and ceremonies to be observed on the occasion. In one place the symbols of different deities to be placed in the divisions of the diagram are described, as a *triṇul* or trident for RUDRA, a discus for VISHNU, a lotus for BRAHMĀ,



a spear for SAMVARA, a thunderbolt for INDRA, a furnace for AGNI, a club for YAMA, a sword for NAIRRITA, a noose for VARUNA, a banner for VAYU, a staff for KUIVERA, &c. No. 14, the *Susididhikara Mahā Tantra*, is a work on the usual *Tantrika* subjects, but held in high estimation.

The 20th volume is interesting for its antiquated style, its different purport, and its being authority only with the *Nyig-mā-pa*, the oldest Buddhist sect in Tibet. It contains three works; the *Sarva dherma Mahāsānti bodhi Chitta Kalaya Raja*, the royal instructor of the understanding in the great quiescence of all virtue. The second has a still longer title, with its equivalent not only in Tibetan but in what is called the *Bruzha* language, a language of which Mr. CSOMA could obtain no information. It is also said to be translated from that language. The third has a simple denomination, the mysteries of all the *Tathāgatas*. It is regarded however as a continuation of the second. The mysticism of these works is of a different character from that of the others, and is doctrinal, not ceremonial. They also belong to theistical Buddhism, being revealed by the Supreme Soul, the Creator of all things, and who has existed from all eternity, in answer to the question of VAJRASATWA the chief of the five Buddhas, styled elsewhere the *Dhyāni* Buddhas. The first was translated in the 8th or 9th century by SRI SINHA PRABHA and the interpreter VAIROTSANA, the second (from the *Bruzha* language) by DHERMA BODHI DĀNA RAKSHITA and the interpreter CHHE'-TSAN-SKYES.

The 21st and 22nd volumes contain severally four and fifteen works of the same description as those which preceded the contents of the 20th; they do not need any particular specification. In the fourth line of the 22nd volume directions are given for the representation of the five Buddhas, VAIROCHANA and others, with their symbols. The Buddhas, Bodhisatwas, and others, who are the interlocutors in these works, or the objects addressed by them, are as before VAJRASATWA, VAJRAPĀNI, MANJU' SRI', HERUKA, and VAJRADJARA. The doctrine or worship of Illusion or *Māyā* occurs in the *Vajrasatwa Māyā jāla Guhya Sarvā dershā*, the mirror of the mysteries of the net of illusion of *Vajrasatwa*, the 3rd article of the 21st volume, and in the 1st of the 22nd, the *Mahamāyā Tantra*.

Thus terminates the great collection, the *KAH-GYUR*, a vast specimen of misdirected talent and time. Imperfect as the summary view given of its contents must necessarily be, it is evident from it, that there is no very great variety of subject, and that the general character of the composition is monotonous identity. The patience and perseverance

of Mr. CSOMA, in going over the whole of these bulky volumes in the manner he has done, will entitle him, I have no doubt, to the thanks not only of the Society, but of a considerable number of the learned of Europe, who are at this moment warmly interested in the investigation of Buddhism. He will have a still stronger claim upon their acknowledgments, if by the translation of some of the philosophical works, he enables them to appreciate what Buddhism really is.

Besides the catalogue of the KAN-GYUR, Mr. CSOMA has made occasional translations at my request, for the illustration of particular points. These are also submitted, as an account of the life and death of SÁK YA, the origin of the SÁK YA tribe, and some passages from the SHER-CHIN.

## II.—*On the Ancient Roman Coins in the Cabinet of the Asiatic Society. By James Prinsep, Sec. Ph. Cl.*

(Read, July 4th.)

Having been lately engaged in decyphering the inscription of an antique copper coin found at Kanouj, by Mr. E. V. Irwin, C. S. and presented to us by Captain Sanders, Executive Engineer at Cawnpore, I was led into an examination of the contents of the Society's small cabinet itself, which, although it boasts but a very insignificant collection of Roman coins, and those mostly without any record of the exact localities in which they were found, or of the parties who presented them, is entitled to some interest from the circumstance of the Indian origin of all that it contains. It was not until the year 1814, that the Society opened a museum, and publicly invited contributions to it of the natural productions, antiquities, coins, and other curious monuments of the country: it is the less surprising, therefore, that its collection should not hitherto have attained any magnitude or consideration. Most private individuals, who have interested themselves in collecting medals and coins, have carried their spoil to England, where, indeed, they may be mortified in finding them swallowed up and lost among the immense profusion of similar objects in the public and private cabinets of European antiquarians; and they may perhaps regret that they did not leave them where, from their rarity, they would have been prized, and, from their presence, have promoted the acquisition of further stores for antiquarian research from the wide continent of India. The greater part of the late Colonel Mackenzie's collection was thus consigned to the museum of the Honorable Company in Leadenhall Street. Doctor Robert Tytler also presented to the same museum a

valuable cabinet, chiefly of Roman coins, procured by him with great industry while Civil Surgeon at Allahabad. Col. T. Wilson, c. n. lately carried hence some curious coins; and many other private collections might be mentioned, without alluding to the extensive cabinet of Major Tod, which cannot be said to be lost to India, but rather to be returned to us more valuable than before, through the plates and notes in elucidation of them published in the Royal Asiatic Society's Transactions.

The publication of a *catalogue raisonné* of the contents of our drawers, although it may expose our present poverty, will, I doubt not, by a wholesome re-action tend to our future enrichment, both by establishing a nucleus to which the antiquities henceforth discovered will be naturally attracted, and by affording to inquirers, who may not have the opportunity of consulting books on the subject, some clue, however insufficient, to the decyphering of worn and imperfect medallie remains, which appear to a novice to defy scrutiny.

We here possess the advantage of reference, in the Society's library, to the splendid numismatic works that were printed in Europe, during the last century, when numismatology was a favorite study. The copious volumes of Vaillant, Patin, Mezzabarba, Hunter, and Banduri, leave hardly a possibility of doubting the exact epoch of a Roman coin, when the device on either side, or a few letters only of the inscription are still visible. It is by means of these works, that I have been able to decypher and classify the greater part of the coins in the following catalogue:—I have added to the list several that were the private property of Mr. Wilson, Col. T. Wilson, or myself, found in different parts of India: I have also availed myself of a manuscript catalogue of the Society's coins, drawn up by Dr. R. Tytler, in the year 1826, which includes the mention of twelve Roman coins.

The number in the cabinet at present amounts to between 50 and 60: they extend in antiquity through a period of more than 1000 years, from the Augustan age down to the decline of the lower empire. The accompanying plates exhibit the greater number of them faithfully delineated, of their real dimensions and appearance, with all the defects of workmanship and the injuries of time. There are few among them which would be objects of primary interest among professed medallists at home, who, in the profusion of Roman coins every where discovered in Europe, are content with none but those of superior fabrication and high preservation, worthy of the titles of *medals* and *medallions of large and smaller mo-*

*dulus*, fancifully conferred upon them in their class books. We possess none of what are usually called *medallions* of "large brass:"—those beautiful specimens of the die-sculptor's art are supposed to have been struck less with a view to circulation as coin, than as memorials of state events and families of note. The pieces found in India are chiefly of the lower denominations, the common currency of the eastern part of the empire, and if it were allowable to argue from such insufficient data, the predominance among our specimens of the copper coin of Egyptian fabrication confirms what is known from history, of that country having been the principal channel of commerce between India and the Roman Europe. Robertson says that specie was one of the principal returns in trade for the spices, precious stones, silk, &c. of India: it is not improbable, therefore, that the coin of the empire circulated to a considerable extent in India; and that there existed no native currency at an early period among the Hindús, we have the authority of Pausanias, and the silence of other authors on the subject: this supposition is supported by the almost, nay, total absence of the remains of any ancient Indian coinage. The Indian coins of Kanouj and the *Dekhan*, described by Mr. Wilson in the *As. Res.* and the Indo-Grecian coins of Major Tod, are evidently *descendants* from the Bactrian coinage, from the types of which they gradually progress into purely Hindú models; but these are comparatively scarce, and must soon have given place to the coins of the Muhamedan conquerors. Coinage is certainly one of the improvements which has travelled and is still travelling eastward. Thus we see, at the present day, countries immediately to the east of us, Ava and China, nearly destitute of fabricated money of their own; into the former of which our silver and copper currency is but now by degrees beginning to penetrate, while the latter along the coast is supplied with dollars from America; and, within perhaps a century or so\*, in its north-western provinces with coin struck by the neighbouring frontier states of Nipal, Lahore, &c. for their use. But this is a digression involving questions of deep research, foreign to my present object, and which I am by no means prepared to discuss.

The symbols on the Roman coins, unlike those of the Greeks, are generally explained at once by the inscriptions encircling them: thus *SALVS REIPVB*, or *SALVS AVG*, accompanies the type of a female feeding the serpent of the goddess of health. at an altar: *CONCORDIA*, *ABUNDANTIA*, *PROSPERITAS*, &c. are all marked by the cornucopia; the ca-

\* The Chinese provinces north of the Himalaya, Tibet, &c. were supplied with coin struck in the valley of Nipal.—*Dr. Branley's Notes on Nipal Coinage.*

duceus expresses peace or commerce ; the pontifical hat, the priesthood ; military standards and warriors, glory and victory : a fort, or gateway, security, &c. The eagle generally denotes the consecration of an emperor, as the *thensa* or divine chariot is the emblem of that of an empress. All, or the greater part, of the types on the reverse of the coins of the emperors have reference therefore to some attribute or event of their reign : and when accompanied by the date of tribunate, consulate, imperial or pontifical elevation, &c. are so many imperishable testimonials of the truth of history. In not a few cases they have served to fill up blanks or to rectify doubtful events ; and they have brought down to our sight not only the record of facts, but the very portraits of the monarchs, heroes, law-givers, and authors, whose deeds and words form the delight of our studies from our youth upward. It may be regretted, that the Roman coins did not directly exhibit the calendric date, especially after the entire reformation of the calendar under the first of the Cæsars ; but with this sole exception what system of modern coinage, in the world, can stand a competition with the Roman or its prototype the Greek, the two earliest supposed to have been introduced among mankind ? If as a contrast we look but one moment at the system of coinage prevalent in the nineteenth century throughout the extensive provinces of India, what will it impart of the history of our time to after-ages, when all other records shall have perished, or shall want the confirmation of public monuments, and the cherishing memory of a proud posterity ? It will deceive them, as to the name and nation of the ruling power ; as to the date, and as to the place of coinage ! It will afford neither information, nor variety, nor beauty of design to gratify the curiosity of future antiquaries ; the very excellence of its fabrication will be thought to have been lavished on an object unworthy of a great and enlightened nation ! But this also is a digression, only excusable as it serves to enhance the value to us of the precious reliques of antiquity.

As the contents of our cabinet are to be regarded in the light of mere coin, a few remarks are necessary, to explain by what names they went and what value they represented ; this part of the subject is generally disregarded by writers on medals, properly so called, who look to their *numismatic* value only as elucidatory of history and the arts ; it has however received a very clear illustration in Pinkerton's Essay on Medals, from which we collect the following facts. The gold coin of Rome (*aureus*) varied gradually in weight from the Augustan æra to the close of the empire, though in a less degree than the coins of the other metals ; it was, under the first emperors, 110

grains in weight, passing for 25 silver denarii and 100 sesteratii : it declined to 80 grains in Gallienus' time : Aurelian attempted in vain to restore its weight to 100 grains. Besides the term *aureus*, it generally took a cognomen from the emperor, whose image it bore, as is still the case with the coin of many modern countries. Constantine introduced a new name and system of subdivision of the gold coin, but maintained his *solidus* of gold of the same weight as the *aureus*, or 80 grains ; it became current throughout Europe as the *Byzant* (from Byzantium), and gradually dwindled to less than half its size and value with the decline of the empire.

The principal silver coin of the republic was called *denarius* : it weighed 90 grains, and was worth, as its name implied, 10 copper *ases* : its subdivisions were the *quinarius* (5 *ases*), and the *sestertius* (half the third, that is,  $2\frac{1}{2}$  *ases*). In the reign of Augustus the weight of both copper and silver coins had declined, and the *denarius* (then of 60 grs. weight) was made equivalent to 16 *as*. The *sestertius* thenceforward ceased to be a silver coin, and in lieu thereof, the handsome large brass medals, so prized by collectors, were first struck, weighing a Roman ounce. The silver *quinarius* (also called *victoriatas* from the common figure on its reverse) lasted to the time of the Philips. At that period the denarius having diminished to 40 grs. was called *minutus*, and a new piece called *argenteus philippus* of 60 grs. or one-half heavier, was introduced as an equivalent for 24 *ases* of copper, or six brass *sestertii*. This again dwindled down to 40 grs. by the time of Gallienus, when all the inferior silver, as well as the large brass, disappeared entirely, and small silvered copper pieces (*denarii aris*), weighing 60 grs. took the place of the sesteratii, and passed current as tokens of 10 *ases* value ; the silver *philippus* itself being, as before, 60 *as*, or six of the plated denarii. Diocletian restored the *silver denarius* of 60 grs. and replaced the *denarius aris* by the *folles*, a new copper coin of  $\frac{1}{2}$  an ounce, silvered or tinned : six of these as before were equal to the *denarius*, or to 60 copper *ases* of 60 grs. weight each.

Once more, the new *denarius* had declined to nearly 40 grs. by the time of Constantine, under whom its name was changed to *centenionalis*, so called because 100 pieces = 1 lb of silver, and a new 70 grs. piece was instituted, having the title of *milliarensis*, from 1000 pieces being equal in value to one pound of gold. The copper *folles* remained of half an oz. in weight, but 24 now went to the *milliarensis* : Numerous fractional parts of the latter also were made : the *ημισυ φολεος*, or  $\frac{1}{2}$  ; *τεταρτον*, or  $\frac{1}{4}$  ; *οβολον*, or  $\frac{1}{16}$  ; *ασαριον*, or  $\frac{1}{32}$  (now of only 20 grains,) and the *νομιμον*, or  $\frac{1}{16}$  ; from this last coin, the marks upon

the copper pieces of the lower empire are supposed to be derived; thus the Greek numeral M. on a copper piece weighing  $\frac{1}{2}$  an ounce, shews it to be a *folles* or 40 *vaupia*: K stands for 20, I for 10, of the same unit, &c.

In describing the silver coin, I have unavoidably introduced as much notice of the copper coinage as is requisite for the purpose of recognizing, or naming, all that will come under review in the following catalogue. The *as* was the *pysa*—the penny piece—of the Romans from first to last, merely declining in weight from one pound in the time of Servius Tullius, to half an ounce in that of Augustus, and to 20 grains in that of Constantine the Great.

The money of account was distinct from the coin, being estimated in *sestertii* and *sestertia*; the *sestertium* (*pondus*), or  $2\frac{1}{2}$  *centum denariorum* being equal to 100 *Sestertii*, or about £8 6 8 English money; but with this we have nothing to do at present, and it is high time to turn to the coins before us.

### Gold Coins.

In the ASIATIC RESEARCHES, vol. III. is a notice of the discovery of a number of Roman coins, chiefly of gold, of the second century, by a peasant, in digging the remains of what appeared to be an old Hindú temple near Nellore, 100 miles west of Madras, in the year 1787. Many were melted up as old gold, but 30 were recovered by Nawab Amir-ul Amra, who allowed the Governor of Madras, Mr. A. Davidson, to make a selection of two from the number for himself. He chose an *Adrian* and a *Faustina*, of which drawings were sent to the Asiatic Society. "Some of the *Trajans* were in good preservation, and many of the coins could never have been in circulation, they were so fresh and beautiful." This printed record is all that now remains in our archives of the interesting discovery:—the coins were probably brought to India by the Christian or Jewish refugees, who migrated to Mysore in the third and fourth centuries of our æra.

Pl. VII. fig. 1, } DN ARCADIVS PF AVG. *Dominus noster Ar-*  
A. D. 392. } *cadivus pius filius Augustus.* Front face of the  
prince, juvenile, in helmet and armour: an equestrian device on the shield.

*Reverse.* NOVA SPES REIPUBLICÆ. below, CONOB.

*Type.* Victory seated, half naked, inscribing five crosses or xx xxx on a shield; a star on the left.

*Weight* 70 grs. troy:—The *solidus* of Constantine and his successors.—*As. Soc.*

This coin does not agree with any engraved in Bandurius or in Vaillant : it is however described by the former vol. ii. 529, with the difference of  $\beta$  in lieu of  $\Theta$ , marking it of the second instead of the ninth year of his reign. The signification of the five X's does not appear to be understood, nor to whom *nova spes* refers, unless it was struck by the emperor Theodosius, on consecrating his son as Augustus. Bandurius entitles his similar coin *rarissimus*.

**Fig. 2.** } DN ARCADIVS PF AVG. Head of a youthful prince  
A. D. 389. } looking to the left, with chaplet and toga.

**Reverse.** CONCORDIA AVGGG S (*an. 8.*)

**Type.** Helmeted female sitting on the prow of a ship, with spear in the right hand and a shield in the left, inscribed  $\nu$  o  $\tau$   
V MVLX

**Weight** 65 grs. **Solidus.**—

This coin is depicted in Bandurius, page 527, *an. II.* It is, as all those with mention of votes, esteemed a very rare coin. It was given to me by Mr. Walter Ewer.

### Silver Coins.

**Fig. 3.** } ROMA X on the exergue, or below the image of a  
B. C. 200. } head armed with a winged helmet ; either of Pallas or  
of Dea Roma.

**Reverse.** On the exergue SGERII, an equestrian figure on the right, and traces of a pedestrian on the left. There is a hole through the coin : it is in the possession of Col. Wilson.

The X probably denotes that this coin is the ancient *denarius*, which bore the impress X, (meaning 10 ases.) Pinkerton supposes that the value of the *denarius* was changed to 16 ases about 175 years before Christ ; if so, this coin must be of very ancient fabrication, and it may be the more valuable, because none of precisely similar appearance is to be met with in the books to which reference has been made.

In the earliest times of the Roman coinage, the silver *denarius*, *quinarius*, and *sestertius*, all bore alike on the obverse the winged head of Pallas with the simple word ROMA, and the marks of value X, V, or HS respectively : and on the reverse, the mounted *Dioscuri*, or Castor and Pollux. Perhaps the present indistinct device may be of this nature, although from the epigraph it seems rather to point to some victory over the Germans. Perhaps the latter, which was indistinct, may have been SPQR. I am not able now to refer to the coin to decide this point.

**Fig. 4.** } CÆSAR AVGVSTVS.....ATRIÆ. The first part  
B. C. 1. } of this inscription is barely visible, and a part of the  
coin is cut off. Well defined head of the emperor.

**Reverse.** ....L CÆSARES. The rest illegible.

**Type.** Two figures standing and supporting two shields, the one partly covering the other.



# ROMAN COINS PL. I.

## GOLD



## SILVER



## COPPER





This coin is doubtless the same as one described by Mediobarbus (page 39) of the 14th year of Augustus. The full inscription would then be CÆSAR AVGVSTVS DIVI F PATER PATRIÆ. And on the reverse, below, or on the *exergue*, as it is called, "C et L CÆSARES (*Caius et Lucius*) AVGVSTI FILII COS DESIGNATI PRINCIPES JUVENTUTIS. *Type.* Dux figuræ togatæ assistentes clypeis cum hastis puris."

Caius and Lucius, the sons of his daughter Julia, and Agrippa, were adopted by Augustus as his successors upon the birth of the latter (16 B. C.); were designated *principes juventutis* at twelve and thirteen years of age, and "*Consules post quinquennium*," Caius in B. C. 5, Lucius in B. C. 1. The present coin probably belongs to the latter year. The two princes died within four years after.

*Fig. 5.* } TI CÆSAR DIVI AVGV F AVGVSTVS. Head of the  
A. D. 6. } emperor Tiberius in good preservation.

*Reverse.* PONTIF MAXIM.

*Type.* A figure seated, (either the emperor, as officiating priest, or *Dea Clementia*;) a spear in the right hand, an olive branch in the left.

*Weight* 60 grs. The silver *denarius*.—*As. Soc.*

Tiberius Cæsar, the adopted son and successor of Augustus, was made *Pontifex Maximus* in the seventh year of his reign. Mediobarbus mentions but one silver coin corresponding with this in device; it must therefore be scarce and valuable.

*Fig. 6.* } ..ASIANVS AVGV COS II. V. P. Head, a good deal  
A. D. 70. } worn.

*Reverse.* SALVS AVGV.

*Type.* A female figure standing before an altar, offering food to a serpent.

There is no coin of VESPASIAN in Mediobarbus exactly resembling this in type, and bearing the same date, but the device is common enough.

*Fig. 7.* } ..MAXIMVS CÆSAR GER. Head of the emperor  
A. D. 236. } distinct.

*Reverse.* Illegible, probably *Princeps Juventutis*.

*Type.* An armed youth, standing.

*C. Jul. Ver. Maximus* was nominated *Cæsar* and *Princeps Juventutis* at the age of 18, by his father Maximus: he took the title of *Germanicus* with his father during their campaign in Germany, on the following year, when they were both killed in their tents.

### Copper and Brass Coins.

*Fig. 1.* } ...AVGVST... Well executed head of the emperor.  
A. D. 14. }

*Reverse.* SC [*senatus consultu*] enclosed in a wreath of laurel.

A brass coin, weighing 118 grains, or  $\frac{1}{4}$  oz.; in value 1 *as*. None of the coins of Augustus enumerated in Mediobarbus precisely agree with this; those struck by

Tiberius, in honor of his apotheosis, resemble it most; but the wreath in them was of oak, the inscription DIVVS AVGVSTVS.

B. C. 40, } CÆSAR AVGVST PONT MAX TRIBVNIC POT.

A. D. 19. } Head of Augustus without the laurel.

Reverse. S.C. encircled by III. VIR·A·A·F·F·P. LVRIVS AG-  
RIPPA.

This is one of the coins denominated *nummi monetales*, bearing the name of the mint-master of the time, *Lurius Agrippa*. There were three prefects or moneyers in the Roman *ærium*, one for each of the precious metals; as explained by the inscription *Triumviri Aeris Argenti Aurique Flandi Feriundi curam habuere*. They were chosen from the members of the senate, and the names of nearly fifty mint-masters of those ancient times have been faithfully preserved on the coins of Augustus alone. A similar coin is depicted in the *Edin. Encyc. Numism.* Pl. cccxx.

Fig. 2. } ...ESAR·DIVI·AVG·F·AVGVS... Head of Tiberius

A. D. 15. } Cæsar facing the left.

Reverse. ..BVN POTEſT XVII. PONTIF MA... In area S.C.

Type. A female figure seated, holding in one hand a cup, and in the other the *hasta pura*, or blunt spear.

Weight 165 grs. Copper; much worn.

This is known to belong to Tiberius from bearing his title of *Divi Augusti filius*. It agrees with a coin described in *Mediobarbus*, 64.

A. D. 84.—Legend illegible, head recognizable as that of Vespasian.

Reverse. S C, below ROMA.

Type. A square frame,—the gate of a temple?

Fig. 4. } MP TRAIANO AVG GER DAC PM. Head of the  
A. D. 107. } emperor.

Reverse. Optimo PRINCIPI. Most of the inscription effaced.

Type. Emperor standing with sceptre in left hand; right hand outstretched to a suppliant figure at his feet. In area S C.

Weight 368 grains. Brass *sestertius*—H. H. Wilson. *Med.* 157.

Trajan assumed the title of *Dacius* upon the reduction of Dacia, and its formation into a Roman province, A. D. 106. The type probably refers to the reduction of an insurrection on the following year.

Fig. 5. } HADRIANVS AVG COS III... Well executed  
A. D. 137. } head.

Type. Figure of Victory holding a branch; no legend. S C on the area.

Weight 465 grains. Brass *sestertius*.

*Mediobarbus* explains, that coins of the emperor Hadrian, bearing only S C on the reverse, belong to the year A.V.C. 890, or A. D. 137.

Fig. 6. } hadRIANVS... Head similar to the last.  
A. D. 137. }

**Type.** Female standing, and holding a branch. S C in area.

**Weight** 174 grains. A copper *assarium*.

**Pl. II. fig. 15.** }  $\text{ΙΟΥΛΙΑ ΣΗΒΑΣΤΗ}$ . Head of Julia Augusta, the  
A. D. 200. } wife of Septimius Severus.

**Reverse.** ΠΡΟΥΣΑΕΩΝ,

**Type.** A standing female figure, with spear and wreath.

Patinus (page 233) says, that of many cities of the name of Prusæ, the most probable one to strike a coin in honor of Julia was in Bithynia, near Mount Olympus. the coin is of brass and much worn.

A. D. 180.—A coin of one of the Antonines, by the appearance of the head, but the legend effaced. On the reverse, a trophy, S C. Copper.

**Fig. 8.** } IMP ALEXANDER PIVS AVG. Wreathed head  
A. D. 226. } of emperor.

**Reverse.** PROVIDENTIA AVG ; in area S C. Female figure holding an ear of corn over a pannier ; l. h. a cornucopia.

**Weight** 250 grains. Brass *sestertius*. *Med.* 321.

Alexander was called Pius in this year, on the opening of the Alexandrian baths.

**Fig. 10.** } IMP ALEXANDER PIVS AVG. Head in good  
A. D. 231. } preservation.

**Reverse.** PM TR PX COS III SP. Half naked figure of the Sun, with r. h. elevated : in the left a whip or *flagrum*.

This coin is described in *Med.* 324, and was struck after a victory in Persia.

**Fig. 9.** } ..GORDIANVS PIUS AVG. Much worn.  
A. D. 243. }

**Reverse.** A triumphant car drawn by four horses.

**Weight** 130 grs. Copper *assarium*. *Med.* 340.

**Fig. 14.** } IMP GALLIENUS AVG. Only the lower part of  
A. D. 263. } the letters visible.

**Reverse.** APOLLINI CONS. AVG. A griffin (*monstrum alutum*, *Med.*) Described also in Bandurius l. 158, as a silver coin.

**Weight** 60 grs. Copper, or billon, [plated copper.] *denarius æris*, or *sestertius*.

This is the first of that peculiar system of coinage of silvered copper, the value of which has been so much contested by antiquaries ; they are easily recognised by the rounding of the edges of the letters, probably done to prevent the silver covering being cut by the die. Gallienus' coins of this year are peculiar for land and sea monsters, supposed to refer to the Decennalia, then celebrated with great magnificence.

**Fig. 13.** ..CARCINIA T..KUA.? Face imperfect and illegible  
**A. D. ?** legend. I...A. Female figure standing.

**Fig. 3.** } IMP CLAVDIVS AVG. Emperor's head in radi-  
**A. D. 268.** } ated crown.

**Reverse.** VIRTVS AVG.

**Type.** A soldier standing on the prow of a vessel, holding a branch in the right hand ; in the left, a spear.

**Weight** 55 grains. Copper, *denarius æris*.

**Ditto.** Another coin similar to the last, having on the reverse ÆQVITAS, with the figure of Justice holding a balance.

These coins were inserted in Plate I. under the impression that they belonged to Tiberius Claudius. It requires however but little knowledge of medals to perceive that they belong to Claudius Gothicus, who succeeded Gallienus.

**Fig. 7.** } ..ICTORINVS PP AVG. Head with radiated  
**A. D. 268.** } crown.

**Reverse.** Illegible. Figure of Sol with r. h. outstretched.

**Weight** 35 grs. Copper.

This is a coin of *M. Aurel. Victorinus*, who was associated in the empire with *Posthumus Senior*; he killed the latter along with two other rivals, and reigned himself for six years.

**Fig. 12.** } IMP C TET....PF AVG. Radiated head.  
**A. D. 270.** }

**Reverse.** SALVS AVG. Female offering a cake to a serpent near an altar.

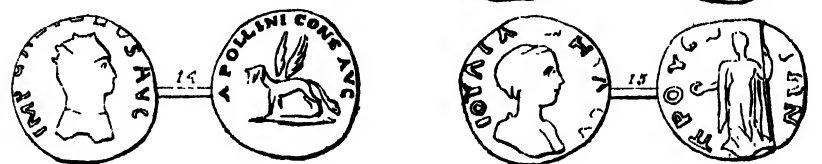
A coin of *C. Fesuvius Tetricus*, Præses of Gaul, under Aurelian, and nominated colleague in Italy with him.

**Fig. 11.** } ΑΚΛΔΟΜΑΤΡΗΑΙΑΝΟC...emperor's head.  
**A. D. 275.** }

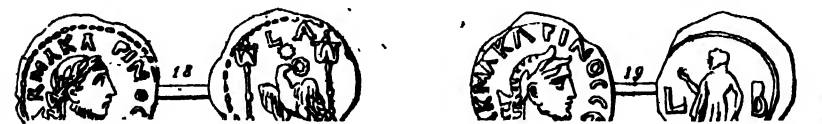
**Reverse.** LE (*an.* 5) with the head probably of Jupiter or Apollo: but belonging to a die of inferior size.

An Egyptian coin of *Imp. Cæs. Luc. Domit. Aurelianus Aug.* described in *Bandurius* I. 387.

The coins of the Roman Emperors bearing Greek inscriptions are of two kinds: those of the Grecian cities, provinces, and colonies had generally the name or insignia of the town where they were fabricated on the reverse, without any date: those coined in Egypt (at Alexandria), had invariably the date or year of the reign, in alphabetic numerals, on the reverse, with various devices, but no legend or epigraph. Some of them have a letter Α or Δ below the type, supposed to designate the town or mint. It is necessary to bear in mind, that the numerals 1 2 3 4 5 6 7 8 9 10 11 20 30 40 50, &c. were represented in Greek by Α Β Γ Δ Ε Ζ Η Θ Ι ΙΑ Κ Λ Μ Ν. The ancient form of the Greek lambda L is supposed to stand for *λυκαβαντος*, *anno (currente)*: sometimes, and



# EGYPTIAN







especially in coins of the *third* year, the word ΕΤΟΥΣ (*anno*) is used in lieu of it, and the ninth year seems to be invariably expressed by ΕΝΑΤΟΥΣ (*nono anno*) instead of ΛΘ. I do not find any explanation of this circumstance, which is probably attributable to some superstition in Egypt respecting the mystical numbers 3 and 9.

- Fig. 16.** } ΑΚΜΑΤΡ ΠΡΟΒΟΣ ΣΕΒ *Imp. Cæs. Mar. Aur. Pro-*  
**A. D. 277.** } *bus Augustus*, Head of the emperor rudely executed.  
**Reverse.** ΛΒ, *an* 2. An eagle bearing a laurel wreath.

- Fig. 17.** } Same inscription, and device; ΛΗ, *anno* 8.  
**A. D. 283.** }

*Probus* was made Imperator of the East by the Emperor *Tacitus*, and recovered a part of Egypt and Persia which had revolted. The weight of these copper coins is 120 grains, or  $\frac{1}{4}$  oz. They are therefore the ἀσπαριον or ὀβολος of the eastern empire.

- Fig. 18.** } ΑΚΜΑΚΑΡΙΝΟΣ Κ. *Imp. Cæs. Mar. Aur. Cari-*  
**A. D. 282.** } *nus Cæs.*  
**Reverse...** ΛΑ, *anno* 1. An eagle holding a wreath between two military standards.

- Fig. 19.** } Same image and superscription of the Emp. *Carinus*.  
**A. D. 283.** }  
**Reverse...** ΛΒ, *anno* 2. Female holding in the right hand a flower; in the left her robe. *Band.* 538.

This is a brass coin; it was dug up in the neighbourhood of Mirzapoor.

- Fig. 20.** } ΑΚΜΑΝΟΤΜΕΡΙΑΝΟΣ ΣΕΒ *Imp. Cæs. Mar. Aur.*  
**A. D. 284.** } *Numerianus Aug.*  
**Reverse...** ΛΒ, *anno* 2. An armed and helmeted female sitting on a shield: r. h. an image of victory; l. h. a spear.  
*Weight* 140 grs. Copper.

*Numerianus*, younger brother of *Carinus*, accompanied his father *Carus* in the Persian war: on his death, he succeeded to the empire, and reigned for two years.

- Pl. III. fig. 24.** } ΑΚΓΟΥΤΑΔΙΟΚΛΗ.... *Imp. Cæs. Caius. Val.*  
**A. D. 285.** } *Diocletianus Aug.*  
 ΛΒ, *anno* 2. Female bearing a branch and a cornucopia; a star on the right.

- A. D. 285.**—Two similar coins of the same year, with Justice holding a balance.

- Fig. 25.** } ....ΔΙΟΚΛΗΤΙΑΝΟΣ ΣΕΒαστος.  
**A. D. 286.** } ΛΓ, *anno* 3.: Female with wreath and cornucopia.

- Fig. 26.** } ΛΔ, *anno* 4. Female helmeted: r. h. a victory; l. h.  
**A. D. 287.** } cornucopia. A shield on the ground. *Band.* 11. 39.

- Fig. 27.**—ΛΔ, *anno* 4. Legend illegible; r. h. an eagle?

*Fig. 28.* } *L Z, anno 7.* Jupiter naked with a spear in the left  
A. D. 291. } hand, and thunder in the right ; at his feet an eagle.

*Fig. 29.* } *L H, anno 8.* Jupiter seated with the same accom-  
A. D. 292. } paniments ; beneath A. *Band. 39.*

*Fig. 30.*—*L H, anno 8.* Same type as *fig. 28.* *Band 39.*

*Fig. 31.* } *L E N A T O R, anno 9.* Female figure in tunic, holding  
A. D. 293. } a flower in the right hand ; gathering her garment  
with the left : below A. *Band. 39.*

This coin was procured at Kanouj, by Mr. E. V. Irwin, C. S. and was presented to the Society by Captain Sanders, Engineers, 1832.

*Fig. 32.* }  
A. D. 294. } *L I, anno 10.* The eagle bearing a wreath.

*Weight 120* grs. Copper. This device is not in *Bandurius*.

*Fig. 34.* } *Λ K M A O V A M A Ξ I M I A N O C C E B Imp. Cæs. Mar.*  
A. D. 284. } *Aur. Maximianus Aug.*

*L A, anno 1.* Female holding an olive branch or flower, and a cornucopia. *Band 80.*

*Fig. 35.*—*L A, same device.* Two cornucopiæ ; star on the right.

*Fig. 36.* }  
A. D. 285. } *L B, anno 2.* Similar device ; star on the left.

*Fig. 37.* } *L S, anno 6.* A winged female holding a flower wreath  
A. D. 290. } in the right hand, and a palm branch in the left.

*L S, another in every respect similar.*

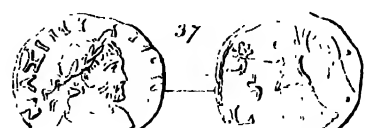
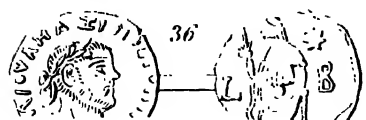
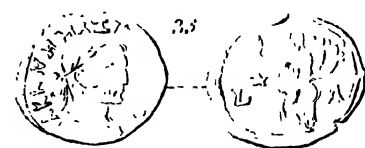
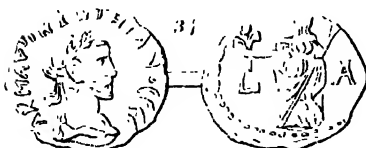
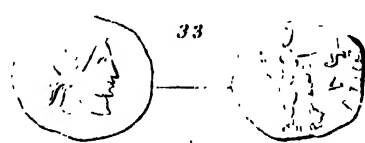
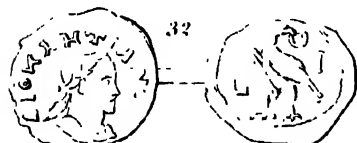
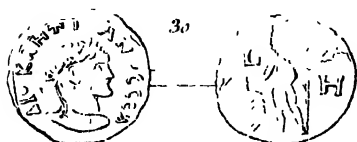
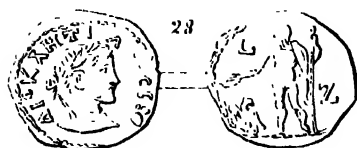
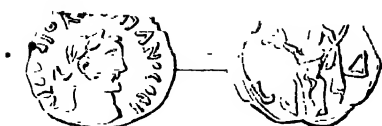
*L S, another belonging to J. P. Band. 81.*

The above series of coins embraces ten years of Diocletian's, and six of his colleague Maximian's, reign. These two emperors called themselves the Jupiter and Hercules of the state, and frequently impressed the effigies of those gods upon their coins.

The fabrication of money, bearing Greek inscriptions in Egypt, ceased altogether in the twelfth year of the reign of Diocletian, A. D. 296, when Egypt was united to the rest of the empire by the defeat of the tyrant Achillæus ; after which period, its coin bore the usual Latin legends. Our series reaches within two years of this date.

*Pl. III.* } This coin was procured at the ruins of *Manikyala*, in the  
*Fig. 33.* } *Panjab*, by Lieut. Burnes and Dr. Gerard, in 1832.

From the *L S*, and the appearance of the device, I supposed it to be a Roman coin of Egyptian fabrication of the second or third century : but on a closer examination, I am inclined to think, that it is a Bactrian coin, similar to those which are described by Mr. Wilson, in his paper on Indian coins in the *As. Res. XVII. Pl. II. fig. 25.* Their device is a figure on horseback, with arm outstretched ; the *L S*, forms part of the head and ear of the horse, and the arch of his neck are faintly visible on the coin, although not represented in the plate, for want of shading. The *bandclettes* of the head on the obverse also agree better with the coins of the Bactrian dynasty, as well as the size and weight of the coin.





**Fig. 38.** } **MAXENTIVS PF AUG.** Head much worn.  
**A. D. 309.** }

**Reverse.** **CONSERVATORES VRBIS SVAE,** beneath **IACT.**

**Type.** A statue of *Roma*, seated in a temple of 6 columns.

**Weight** 105 grs.—the *half follis* described in *Band. II. 154.*

**Fig. 39.** } **CONSTANTINUS MAX AUG.** Head with a wreath  
**A. D. 307, 312** } of jewels.

..... **EXERCITUS** (*gloria exercitus*).

**Type.** Two military standards with armed supporters ; some letters below illegible.

**Fig. 40.** } **CONSTANTINUS AUG.** Head of the Emperor.  
**A. D. 302.** }

**Reverse.** **PROVIDENTIÆ AVGG.** Below **SMANTE.**

**Type.** A gate or arch (*castrorum porta*, *Band. 278*) surmounted by two globes, and a star in the centre.

**Ditto.**—Another coin of similar inscription and type. Head laurelled.

**Ditto.**—**CONSTANTINVS MAX AUG.**

**GLORIÆ X EXERCITVS.** Military standard. **SMANS.**

This coin is reckoned rare by *Bandurius*, as it bears the Monogram of Christ.

**Fig. 41.** } **CONSTANTINVS AVG.** Head with plain band.  
**A. D. 335.** }

**Reverse.** **DN CONSTANTINI MAX AVG.** Below **SMNA.** *Med. 468.*

**Type.** A wreath enclosing **VOT XXX.**

**Weight** 60 grs.

This coin must be a *denarius æris*, coined previous to the introduction of the large copper follis of 240 grs.

**Fig. 42.** } **CONSTANTINOPOLIS.** A juvenile head (of Con-  
**A. D. 330.** } stantine junior ?)

**Reverse.** Legend wanting : Victory with outspread wings sitting on the prow of a ship, with spear and shield : below **SMALR.**

**Weight** 40 grs.

This piece differs in the epigraph from any enumerated in *Bandurius* : it is not certain whether *Constantine* himself struck any coins in honor of his new capital, or whether they originated with his successors. **A. D. 330** is the date of the dedication of the new city.

**A. D. 330.**—**VRBS ROMA.** Juvenile head helmeted.

**Reverse.** Romulus and Remus suckled by a wolf : two stars above ; below **CONSE**

Coins of the imperial city seem to have been struck at the same period with those of its rival Constantinople, to prevent jealousy between the two.

**Fig. 43.** } ...VL CONSTANTIVS NOB C. *Flavius Julius Con-*  
**A. D. 330.** } *stantius...Nobilis Cæsar.* Head with plain band.  
**Reverse.** GLORIÆ EXERCITVS. Two standards and martial  
 supporters : below...CP..

**Weight 50 grs.**

*Constantius* was made Cæsar by his father *Constantine the Great*, in 323.

**A. D. 330.—FL IVL CONSTANT NOB C**

GLORIÆ EXERCITVS. Below, CMB. Standards.  
 There are two or three coins of similar device.

It is difficult to say, whether the last two are coins of *Constantius*, or of his brother *Constans* : both having the same names FL. IVL The coins of *Constantine* and his family are extremely numerous, and have nothing to mark their precise dates. *Bandurius* arranges them alphabetically, according to the legends on the reverse.

**A. D. 337.—DN CONSTANTIVS PF AVG.** Head with ornamental wreath.

**Reverse.** FEL TEMP REPAR...Below illegible.

**Type.** A captive thrown from his horse, is pierced by the spear of a Roman soldier.

The device of this small coin is very neatly executed.

**Fig 44.** } DN VALENS PF AVG. Head with plain band.  
**A. D. 364.** }

**Reverse.** SECVRITAS REIPVBLICÆ indistinct. Victory stepping forward : on the face SP ; below ASISCL.

This coin is described by *Mediobarbus*, 506. *Valens* was put in charge of the western empire by his brother *Valentinianus* in the year 364.

**Fig. 45.** } .....DOSIVS PP..Head with star on the right.  
**A. D. 393.** }

**Reverse.** GLORIA ROMANORVM. Three figures standing, armed with spears. *Mcd. 519.*

*Mediobarbus* supposes the three figures to be the Emperor *Theodosius*, with *Arcadius* and *Honorius*, his sons, imploring the divine aid on their expedition to Italy : the coin is rare ; it was found at *Mahabalipuram*, along with several others, bearing the same device, but of a smaller size. They belonged to Col. *Mackenzie's* cabinet.

**Weight 30 grs. ; the σβολον.**

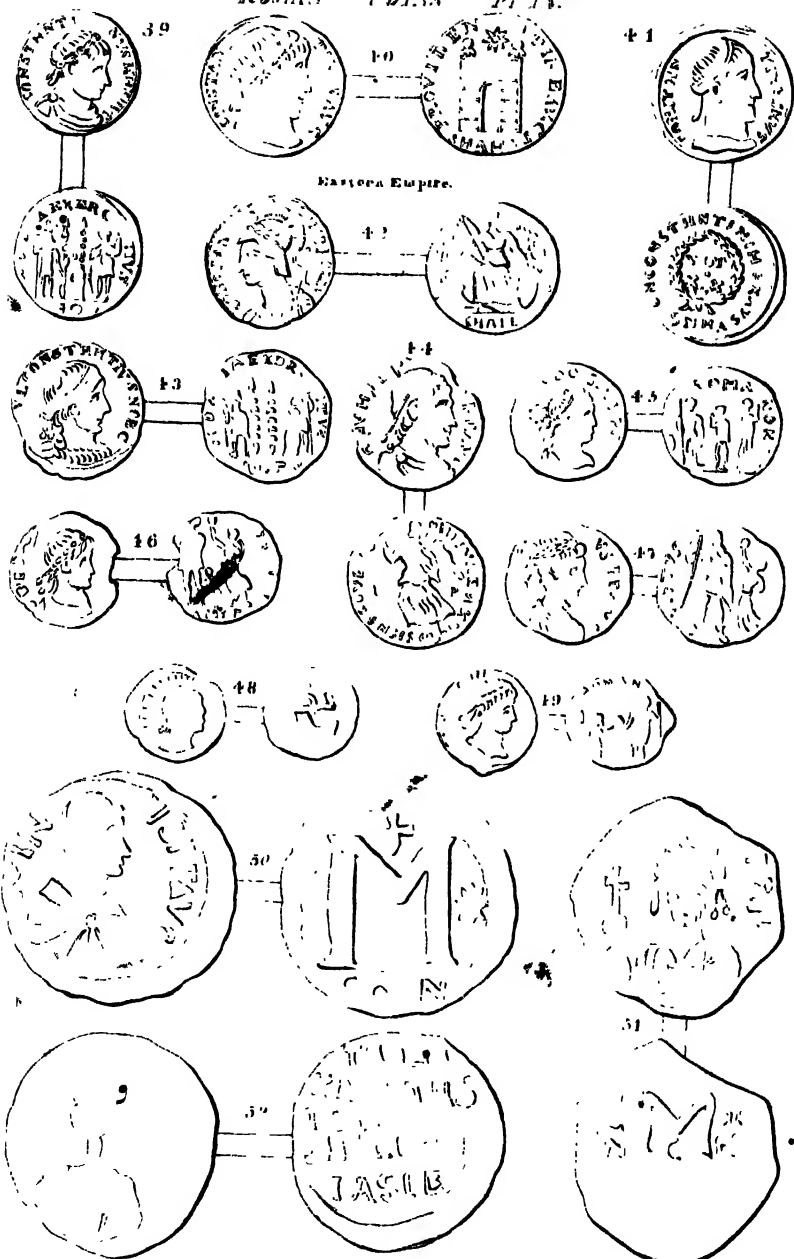
**Fig. 46.** } THEO.... Head of the Emperor *Theodosius* much worn.  
**A. D. 379,395** }

**Reverse.** Illegible. Victory crowning the Emperor.

**Fig. 47.** } .....VS PF AVG. Head of *Arcadius* ?  
**A. D. 403.** }

VIRTVS.....The Prince receiving a crown of laurel from Victory.

ROMAN POLYN P. 111







**Fig. 49.** } DN HONORI... *D. N. Honorius Aug.*  
**A. D. 394.** }

...ROMAN... *Gloriæ Romanorum.* Two figures armed, supporting a globe.

\* *Weight* 20 grs. the *νοῦμιον*.

This device, no doubt, represents the two brothers, but the type is not found in either of our authorities. A coin of *duæ figuræ*, is mentioned in Patin's catalogue of rare inferior coins.

**Fig. 48.**—A small coin referrible to the same period, but unintelligible. On the reverse four legs united, or a cross? From their weight these must be the *νοῦμια*, or smallest copper coins, whence the denominations of those which follow were derived, as explained in the introductory remarks.

**Fig. 50.** } ...INVS PFAVG Probably *D. N. Justinus Pius*  
**A. D. 522.** } *Felix Augustus.*

**Reverse.** \*<sup>+</sup>**M**\* with a globe under the centre of the M. Copper CON *follis*, of very inferior fabrication.

*Weight* 170 grains.

**Fig. 51.** } ...PFAVG. Front face apparently of *Mauricius*,  
**A. D. 585.** } with jewelled head-dress: holding in his left hand a globe and cross.

**Reverse.** <sup>A</sup>**M** <sup>N</sup> **II** The year is not very distinct; c under the M does  
<sup>O</sup> **C** **II** not occur in *Med.* 576, or *Band.* 666. The *follis*.

*Weight* 240 grains.

**Fig. 52.** } Head apparently of Christ, almost obliterated; inscrip-  
**A. D. 970.** } tion on the reverse, very rude and only partly legible...XRISTuS ... BASIL ..

This is a coin of *Joannes Zimisces* (*Band.* 738), the full inscription being *IηSuS XRISTuS BASILeuS BASILEwv*.

*Weight* 140 grains.

**Fig. 53.** } Three-quarter front figure of Christ, with a glory  
**A. D. 970.** } round the head: much worn.

**Reverse.** An ornamental cross, with four globes in the quarters **IC XC NI KA** signifying *Ιησω Χριστω νικα*, which may be the origin of the Latin motto, *In hoc signo vinces*.

*Weight* 170 grs.

JOANNES ZIMINCES, a monk who rose to the throne after the murder of his benefactor Nicephorus Foca, was the first who ventured with dissipated piety to put the effigy of Christ upon his coin. They were thence called *Σωτηρικοί*. The modern Greeks erroneously ascribe them to Constantine the Great. It is a curious fact, that these, which are the most recent coins in the cabinet of the Asiatic Society, should be in the worst state of preservation.

NOTE.—Since writing the above, the Society has become possessed of 250 Roman coins, purchased from an Armenian; as they were not found on the continent of India itself, I do not feel called upon to include them in the present list, although they will be of great use in forming the germs of a future cabinet. Some of them are in high preservation; they comprise

|                   |                     |                    |
|-------------------|---------------------|--------------------|
| 2 of Augustus     | 2 Maximinus         | 32 Diocletianus    |
| 2 Nero            | 1 Septimius Severus | 27 Maximianus      |
| 1 Galba           | 1 Sept. Geta        | 18 Constantinus    |
| 6 Vespasianus     | 4 Alexander Pius    | 2 Constantinopolis |
| 1 Titus           | 1 Gordianus         | 11 Constantius     |
| 3 Domitianus      | 8 Philippus         | 2 Valens           |
| 2 Nerva           | 6 Trajanus Decius   | 2 of Greek Towns   |
| 2 Trajanus        | 8 Gallienus         | 1 Severa           |
| 6 Hadrianus       | 4 Claudius Gothicus | 1 Lucilla Augusta  |
| 45 Antoninus Pius | 2 Aurelianus        | 4 Faustina         |
| 16 Commodus Ant.  | 8 Probus            | 2 Mammeæ           |

and 20 others, more or less illegible. Should any of them turn out to be new or rare, I shall take occasion to notice them hereafter.

### III.—*Observations of the Transit of Mercury.* By James Prinsep, *Sec. Phys. Cl.*

On the 5th of May, the expected transit of Mercury over the sun's disc, a phenomenon which occurs twice in an interval of about 12 years, invited all lovers of astronomy to be prepared at their telescopes. Unfortunately, in Calcutta, the day proved cloudy just at the time when the ingress took place, and, as the sun set before the egress, little advantage could be taken of the event in correcting the longitude; much less in attempting to furnish data for the calculation of the parallax of the sun or of the planet. From half past four to a quarter past five P. M., there were intervals of sunshine sufficient to afford a transient view. Lieutenants Waugh and Rennie, Engineers, endeavoured with me to profit by these moments in taking the position of the planet on the sun's disc. We were permitted the use of a

very fine 4-foot achromatic telescope, belonging to Lieut. Pemberton, of four inches aperture, mounted equatorially, and provided with a delicate wire micrometer. The power used was 60, and the darkened glass was varied to accommodate the light to the eye—the clouds were sometimes sufficient alone to act as a screen against the sun's rays.

For the time we were indebted to Mr. Gray, with whose astronomical clock our chronometer was compared before and after the observation; thus,

|   |    |           |           |
|---|----|-----------|-----------|
| At 9 h. 10 m. A. M.,                        |    | <i>m.</i> | <i>s.</i> |
| Chronometer slow of Ellicott's Clock, ----- | —  | 15        | 46.2      |
| Deduct error of Clock by Me. So. Time, +    | +  | 4         | 55.2      |
|   |    | <hr/>     |           |
| Chron. slow of Mean Time,                   | 10 | 51.0      |           |
|   |    | <i>m.</i> | <i>s.</i> |
| At 5 h. 45 m. P. M. Chron. slow,            | 15 | 50.0      |           |
| Clock fast, (daily rate 0.2 gaining), +     | 1  | 55.2      |           |
|   |    | <hr/>     |           |
|   | 10 | 54.8      |           |
| Chron.'s loss in 8 h. 35 m. -----           |    | 38        |           |
| Daily rate losing, .....                    |    | 10.33     |           |
| Hourly rate 0.43 s.                         |    |           |           |

Correcting the times noted, therefore, the subjoined are the observations expressed in mean solar time. From the rapid motion of the sun, we found it quite impossible to measure the distance of Mercury from either the advancing or the following limb with the wire micrometer; the planet's distance, however, from the tangent of the sun's northern limb, or at right angles to his motion, was taken at three different times, during the series of observations. There is, however, more or less uncertainty in this mode of measurement, from the difficulty of bringing one of the wires of the micrometer to coincide with the sun's limb, as from the darkened eye-glass, the wire ceases to be visible as soon as it is off the disc; the divided object glass micrometer is in this respect preferable.

For the equatorial measurements, we had resort to the times of transit of the sun's two limbs and of the planet past the two wires of the micrometer; repeating the sights as frequently as the weather would permit, by moving the telescope a little in advance before each series of readings commenced. There was a small spot on the sun indistinctly defined towards the advancing limb, the transits of which were also noted: the time occupied by the planet's passage of a wire was about half a second, but as small reliance could be placed on the measurement of such a space, it has been preferred to insert the mean of the two readings, as the passage of his centre. His disc appeared as a

clean circular spot, surrounded with a slightly enlightened ring; his diameter was as near as could be estimated, that of one of the micrometer wires.

The time occupied by the passage of the sun's disc across the wires decreased as the evening advanced, from the effect of the atmospheric refraction contracting his vertical diameter.

*Transits of Mercury and of the limbs of the Sun, past the wires of an equatorial telescope in mean Solar Time, at Calcutta, Lat.  $22^{\circ} 36' 21''$  Long.  $5h 53m. 28s.$*

| Number of the series.  | Passage of $\odot$ 's vancing limb. | Passage of $\odot$ 's the sun. | Passage of $\odot$ 's centre. | Passage of $\odot$ 's lowing limb. | Time of $\odot$ 's diameter passing the wires. | Interval from $\odot$ 's second limb. |
|--|-------------------------------------|--------------------------------|-------------------------------|------------------------------------|--|---------------------------------------|
|  | H. M. S.                            | M. S.                          | M. S.                         | M. S.                              | M. S.  |                                       |
| 1  | 4 30 44.3                           |                                | 31 59.5                       | 32 57.6                            | 2 13.3   | 0 58.1                                |
| 2  | 33 51.1                             | 34 10.3                        | 35 09.0                       | 36 07.8                            | 2 13.4   | 2 58.8                                |
| 3  | 46 40.8                             | 46 57.2                        | 47 51.2                       | 48 51.2                            | 2 13.4   | 1 02.9                                |
|  | 47 01.9                             | 47 21.6                        | 48 17.0                       | 49 18.6                            | 2 13.7   | 1 01.6                                |
| 4  | 49 40.6                             | 49 56.1                        | 50 50.4                       | 51 52.6                            | 2 12.0   | 1 02.2                                |
|  | 50 05.3                             | 50 20.6                        | 51 15.2                       | 52 17.6                            | 2 12.3   | 1 02.4                                |
| 5  | 52 36.5                             | 52 52.5                        | 53 45.7                       | 54 48.3                            | 2 11.8   | 1 02.8                                |
|  | 53 01.5                             | 53 16.7                        | 54 09.1                       | 55 13.7                            | 2 12.2   | 1 03.8                                |
| 6  | 5 00 06.3                           | 00 23.0                        | 01 14.5                       | 02 17.5                            | 2 11.2   | 1 03.0                                |
|  | 00 33.7                             | 00 49.3                        | 01 40.5                       | 02 45.6                            | 2 11.9   | 1 05.1                                |
| 7  | 03 38.0                             | 03 54.3                        | 04 44.7                       | 05 50.3                            | 2 12.3   | 1 05.6                                |
|  | 04 04.3                             | 04 19.7                        | 05 10.2                       | 06 15.7                            | 2 11.4   | 1 05.5                                |
| 8  | 16 05.6                             |                                | 17 09.1                       | 18 17.8                            | 2 12.2   | 1 06.7                                |
|  | 16 33.8                             | 16 59.4                        | 17 36.6                       | 18 45.8                            | 2 12.0   | 1 09.2                                |
| Means  | 4 51 37.7                           |                                | 4 55 46.6                     | 4 56 50.0                          | 2 12.4   | 1 03.4                                |
| Time of $\odot$ 's passing meridian by Nautical Almanack,... |                                     |                                |                               |                                    | 2 12.28  |                                       |

Distance from Mercury's centre to the tangent of the northern limb of the sun, measured with a wire micrometer.

|    | Mean Solar Times. | Divisions of the Micrometer. | In space. |
|----|-------------------|------------------------------|-----------|
|    | h. m. s.          |                              | " "       |
| At | 4 40 00           | 509                          | 5 55.4    |
|    | 4 57 14           | 530                          | 6 10.1    |
|    | 5 07 24           | 568                          | 6 36.6    |

The sun's horizontal diameter measured by the same micrometer, on the 7th May, 6 P. M. was 2727 divisions. By the Nautical Almanack for the same period, it was 1904.0 seconds, which makes the value of the divisions 1.452 per second.

There is too much discrepancy among the foregoing measurements to allow of their being individually useful; the utmost that can be expected from them is the determination of the position of Mercury on the sun's disc at one mean period. As I hope this will be

undertaken by an astronomical friend, who will combine the results here published with his own observations at Madras, I shall leave the subject in his more able hands.

I have been favored with the following observations of the transit at other places :

*At the Surveyor General's Office, Calcutta.*—The mean time of Mercury's outer contact was observed at 2 h. 53 m. 24.2 s., but the sight was not esteemed good, owing to the state of the weather.

*At Chuprah.*—Latitude 25° 43' N. Longitude 5h 39m. E. Mr. Walter Ewer observed the internal ingress of Mercury at 2 h. 42 m. 18 s. mean time. "The telescope was a Troughton's three and a half feet achromatic, aperture two and three quarter inch, and power about 60. The time was taken by equal altitudes of the sun on the preceding day. The nearest approach was at about 6 h. 8 m., taken with a wire micrometer by Troughton; but the sun was so low, the refraction so great, and the motion of Mercury so slow, that this can only be considered an approximation. The precise latitude and longitude of the place are not yet determined."

*At Bareilly.*—Latitude 28° 20' 7" N. Longitude, 5 h. 17 m. 20 s. E. The internal ingress was observed by Mr. H. S. Boulderson, at 2 h. 20 m. 58s. mean time Bareilly. "This observation may be doubtful to two or three seconds, as the planet had just entered the disc of the sun when first seen."

#### IV.—*On the Habits of the Paludinæ.* By Lieut. T. Hutton, 37th N. I.

If it be not against existing rules and regulations, and the matter here furnished be deemed at all worthy a place in your interesting Journal, I propose doing myself the pleasure of sending you occasionally a few extracts from my "Notes on Natural History," accompanied by specimens of any thing that I may consider worthy of your acceptance.

On the 21st and 22nd of June, after a few heavy showers of rain, I ventured forth from my bungalow to a grove of mangoe trees hard by, in search of land-shells, or in fact any thing that might fall in my way; at the foot of many of the trees, the water was lying in pools, and wherever this was the case, I found a great many small shells, with the living animals in them, evidently just forcing a passage

through the moistened earth, and crawling over its surface beneath the water in search of food. I gathered up several of them, and took them home, where they were placed in a tumbler for future examination.

In about an hour afterwards I returned to the same spot, in search of more, but by this time the water had all dried up, and with it had disappeared the shells also. From that time up to the 1st July, we had no more rain, and the weather became in consequence very sultry and oppressive; the heat once more put to flight the various insects, &c. which were just preparing to sally forth, and although I was a daily visitor at the mangoe grove, I made no addition to my museum.

On the 1st, 2nd, and 3rd days of July, the rain descended in torrents, so much so, that the plain all round my bungalow, for some hundreds of yards, was a sheet of water for several hours after.

This state of things gave new vigor to my spirits, for I knew, that when the water should have sufficiently subsided to allow of my going out, a rich harvest awaited me: and I was not disappointed, for my usual haunt the clump of mangoe trees, alone, furnished me with a good supply, not only of the above-mentioned shells, but also with two fine specimens of the wood scorpion and a fresh-water crab.

With regard to the shells, I perceive that in the 9th No. of the GLEANINGS IN SCIENCE, Mr. Benson has made some observations on a small species of *Paludina*, found by him in localities somewhat similar to those observed by me; but as that gentleman seems uncertain of their abode and habits during the hot season, I shall here mention a few observations which I made on finding shells in the situation above described. At the roots of several trees, the water was lying in puddles, and thinking that this might have been occasioned by the droppings from the tree, I stooped down to see if there were any insects or land snails washed down with it, and I there saw, for the first time, the little *Paludina* crawling on the dead leaves, &c. beneath the surface of the water; several of these I took home and placed in a tumbler without any water, where they remained forgotten for a week or more, but on looking at them at the end of that time, they were all firmly closed and shut in by their little calcareous *opercula*; on putting them into water, however, they began to open and crawl about in apparently good health.

On an after-occasion I had the good fortune to observe them pushing aside the moistened earth, and coming forth from their retreats; but on the disappearance of the pools of water, not one of them was to be seen above ground; wishing therefore to ascertain what had become

of them, I turned up the earth at the base of several trees, and invariably found the shells buried from an inch to two inches below the surface.

From this circumstance, I am strongly inclined to think, that during the prevalence of the hot-weather they remain beneath the surface of the earth in a state of torpor, at a sufficient depth to protect them from too great a degree of heat, and the immediate action of the sun upon them, until the refreshing moisture of the rains once more enables and induces them to come forth for the purpose of performing that part, in the great chain of animated nature, for which an all-wise Creator destined them.

Of these shells I have found two species, both in the same situations, and both having calcareous *opercula*.

The largest of the two appears to be identical with that found by Mr. Benson in a ditch at Banda, and the animals of both are similar to those of the other *Paludina*.

No. 1. Animal with the head probosciform; two *tentacula* long, tapering, and retractile; eyes at the exterior base of the *tentacula*; color of the animal pale, with a dirty tinge of white; head and *tentacula* mottled with greyish.

Shell. About  $4\frac{1}{2}$  lines long, with a pale olive-brown *epidermis*; whorls (apparently) 4; the spire very much eroded; aperture angular above and below; deeply umbilicated; *operculum* calcareous; shell conoid; whorls rounded.

No. 2. Animals similar to the foregoing; colour pale throughout, but darkest on the head.

Shell. About 4 lines long, with an olive-brown *epidermis*; whorls 4; spire eroded; aperture sub-ovate, angular above, rounded below; no *umbilicus*; *operculum* calcareous, and at the very edge of the shell, and incapable of being drawn within the aperture; shell conoid; whorls rounded.

In Lamarck's generic description of *Paludina*, he merely says, when speaking of the aperture, "*angular at the summit*." If by this we are to understand, that it is *only* angular at the summit, and *not below*, then my species No. 1 is no longer a *Paludina*, being angular *both above and below*; it therefore remains to determine to what genus it is referrible, or whether it may not constitute a new one.

At all events, I am inclined to think, it cannot be classed with the *Paludina*, as all the shells of that genus in my possession (and I have six or seven species) are angular at the summit alone, agreeing with the generic description.

The circumstance of these shells burying themselves beneath the surface of the earth is by no means peculiar to them; both the *Ampullariæ*, *Planorbis*, and *Paludinæ*, being found in similar situations during the heats of the dry season, as I should suppose Mr. Benson must have observed;—of this I have abundant proof before me in a hollow, which being now full of water, forms a tolerably large jhil, in which all these species occur plentifully; but a fortnight or three weeks ago this same hollow was as hard and dry as the walls of my bungalow, and yet by digging a very little way below the surface, I found both *Ampullariæ* and *Paludinæ*\*, which on being left in a tub of water for about a quarter of an hour, began to crawl about in great vigor.—At the bottom of the tub I placed a quantity of mud, about nine inches or a foot deep, and when after some days, the water by not being renewed, had all evaporated, the shells of both genera had disappeared, and were buried in the mud at the bottom. I allowed them to remain thus for a few days, until the mud became dry, and I could not disengage them from it, without digging them out, when I again furnished them with water, which by moistening the earth enabled them to force a passage through it.

The ova of *Ampullariæ* occur very abundantly at this season, in the small jhil near my house, being deposited in beautiful clusters among the long grass and weeds just above the water mark; in some instances, I saw the animals in the act of depositing them. At first they are rather soft, and contain a gelatinous transparent substance, like the white of an egg, but thicker; in a few hours, they become brittle and covered with a calcareous shell, of a pure white. When fresh and moist, they are very heavy, but become remarkably light on drying. In shape they are sometimes round, sometimes oval, and resemble small caraway comfits stuck together in bunches.

If my present communication be deemed acceptable, I shall have pleasure in continuing from time to time to furnish you with a few lucubrations on similar subjects.

Mirzapore, 23rd July, 1832.

NOTE. We shall always be happy to receive Lieut. Hutton's communications, which are those of a zealous amateur in a field hitherto but little explored.

The doubt expressed by the author as to the first of his species may perhaps reasonably be extended to both, if the structure of the *operculum* be allowed to indicate the structure of the animal; and neither the one nor the other of these *Molluscæ* would belong to the genus *Paludina*.

\* *Paludina* with corneous *operculum*, shell thin and pale-greenish; animal with the head and *tentacula* spotted, orange and black.



In this interesting paper, both species are described as having a *calcareous operculum*, but the under-mentioned authorities describe the *operculum* of *Paludina* as *horny*.

“Un opercule orbiculaire et *corné*”

“*Operculum orbiculare cornutum*”

are the expressions of De la Marek, and which would have been noticed by Dubois if incorrect. Dubois however contents himself by translating them “the operculum *horny* and orbicular.” Mr. Guilding, in his notice of the Zoology of the Caribæan Islands, when speaking of the “*Paludina Anctorum*,” says, “*operculum corneum in dorso pedis*.” And some species found in Bengal have none other than a *horny operculum*.

Again:—the author describes his first shell as “*deeply umbilicated*,” and the second, with “*no umbilicus*.” On this part of the subject Mr. Guilding represents the shell of the genus *Paludina* as “*sub-umbilicata*,” a term well expressive of the rudimental *umbilicus* formed by a slight reflection of the columellar lip towards the body of the shell; De la Marek affords negative evidence by making no mention of any kind of *umbilicus*; and in this country it occurs but in the slight degree mentioned above. All concur in the rounding of the lower part of the aperture.

Upon the whole, therefore, these species do not appear entirely to agree with the characters of any known genera; but this is a point of too much importance to be determined in the absence of an exceedingly minute description, both of the animal and the shell, particularly of the anatomy of the former.

#### V.—Proceedings of the Asiatic Society.

Wednesday, 5th September, 1832.

The Rev. Dr. W. CAREY, senior member, in the chair.

Read the Proceedings of the last Meeting, and proceeded to the ballot, when SIR EDWARD RYAN was elected President of the Society; and

Mr. J. CALDER, Vice-President, in his room.

Dr. Langstaff, proposed at the last meeting, was elected a member.

#### Correspondence.

The Secretary communicated to the meeting an application from the executors of the will of the late Mr. Bruce, for the Society to forego their claim to any further share in the property of the testator in favor of his brother and sister.—*Resolved*, that the determination of the Society be suspended, until they are apprized of the amount of the residuary share to which they are entitled by the will.

The Secretary communicated to the meeting a letter from the Baron de Ferussac, with reports, prospectus, and proceedings of the Société Anonyme of Paris, and proposing to the friends of Literature and Science in India to subscribe for six shares in this Society.—*Resolved*, that the letter and documents accompanying be referred to the Committee of Papers for their report at the next meeting of the Society.

The number of literary and scientific journals issued to the world in the nineteenth century, amounts according to the prospectus of the Bulletin to upwards of fifteen hundred; learned Societies have multiplied in an equal ratio; so that it would occupy a man's life to peruse the mass of information accumulated, even if he could collect together the numerous works containing it. The Baron de Feussac would secure to France the privilege of assembling and concentrating in a focus this scattered knowledge: he is perhaps the only man ambitious, persevering, and laborious enough to put the feasibility of such a scheme to the proof; but the experience of eight years has shewn that he is equal to the task. His Monthly Bulletin Universel, in its eight parts, contains analyses of the contents of every published journal, and with the aid of copious annual indexes, forms a register of all that is done in literature and science, enabling the student of any department to become acquainted with every new fact and discovery, and the historian to trace the progress of each science, from a most perfect and compendious record.

But the scale of the work as hitherto conducted is found to be quite inadequate to embrace the mass of additional matter now offering itself for publication:—and the only mode of effectually keeping pace with the demands of knowledge, is to enlarge the scheme by raising further capital, or forming a kind of joint stock association among those who would otherwise patronize the work as subscribers; and of whom there are already 5000 enlisted.

The following is a general view of the scheme:

There are 500 shares, 450 regular and 50 supernumerary, valued at 1000 francs each: a share may be held jointly by any number of persons not exceeding four.

The holders will be entitled to such annual dividends as may be afforded by the profits of the concern.

The shares are to be transferable and heritable.

Every share-holder has the option of receiving the monthly numbers of the Bulletin to the value of 50 francs, per annum, per share, in lieu of a dividend to that extent, or any thing below it.

According to the prospectus published on the cover of our July No., 50 francs will cover the subscription to any single division of the work, except the geographical. The whole work of eight parts costs 300 francs per annum.

The Society to continue 25 years from the year 1828.

|  |     |     |
|--|-----|-----|
| Of the 500 Shares, France has already subscribed for | 150 |     |
| Original proprietors and coadjutors, .....           | 89  |     |
|  |     | 239 |
| Foreign countries, ..                                |     | 51  |
|  |     | 290 |

There are still 210 shares to be disposed of, and these have been assigned by the projector to the various literary bodies, who have not yet joined the association; thus six shares have been set aside for the members of the Societies at the several British establishments in India, and one share for the Governor General: the originator of the scheme calculates more on the moral support and concurrence of its friends, than on their expectation of pecuniary benefit; and certainly viewing it as a money transaction, unless some prospect is confidently held out of much higher annual dividends than 5 per cent., it is not clear wherein the advantage of investing capital in the concern would lie: the interest of the same sum, safely lodged in the securities of the country, would purchase an equal portion of the

publications of the Société Anonyme : and a subscription for the whole work would be equivalent to the interest of the six shares.

The Treasurer's Report submitted, showing a balance in favor of the Society of Rs. 10,892, 6. 7.

The Collector's Report submitted, shewing a balance of outstanding bills of 11,140, of which 3,856 may be realized.—*Resolved*, that the Subscribers in arrear be written to for payment.

#### Museum.

A number of articles of Tibetan manufacture, presented by Government.

A collection of shells and a dried fish, presented by Dr. Burlini.

A snake, called *Kaulau Ganney*, presented by Mr. George.

A metal box, containing eleven silver rings, and three coins, (two of the Mohammedan Kings of Bengal, and one of Assam,) dug up in clearing an estate in the Sunderbans, sent for inspection by Mr. Storm.

Fourteen specimens of Roman coins, procured in Persia, presented by Mr. Avdall.

#### Library.

Books from the Bookseller, laid on the table.

Rickard's India, Part 4th.

Gray's Indian Zoology, Part 8th.

Lycell's Principles of Geology, 2nd Vol.

Cabinet Cyclopedia,—Military Commanders ; Italian Republics ; and Porcelain and Glass.

Mr. H. T. Prinsep presented Molesworth's *Mahratta Dictionary* on the part of the Bombay Government.

Read a letter from Mr. Twining, presenting a copy of his *Clinical Illustrations of the Diseases of Bengal*.

Read a letter from J. Vaughan, Esq. Secretary of the *Philadelphian Philosophical Society*, dated 20th April, 1830, presenting,

1. Mr. C. L. Bonaparte's *Observations on the Nomenclature of Wilson's Ornithology*.

2. Danas's *Outlines of the Mineralogy and Geology of Boston and its vicinity*.

3. Secretary of Treasury's Report to Congress on the Commerce and Navigation of the United States for 1830.

4. Aghlan's *Flora Cantabrigiensis*.

5. Vols. 4 and 6, and 1st New Series of the *Transactions Americ. Phil. Soc.*

And offering politely to supply any former numbers of the *Transactions* which may not have reached the Society.

Dr. Bowdich's *Translation of the Mecanique Celeste*,—presented by the author.

*Meteorological Registers* for May, June, and July, 1832,—from the *Surveyor General*.

A list of books, some of which it might be desirable to purchase, submitted by Mr. J. Tytler. Referred to the Committee of Papers.

*Resolved*, that the thanks of the Society be presented to the Donors of the above presents.

*Literary.*

A collection of papers on the language and literature of Madagascar, and specimens of Missionary Tracts, printed at Madagascar, were presented by Mr. Calder, on the part of Mr. C. Telfair, President of the Natural History Society of the Mauritius.

We hope hereafter to find room for the insertion of some of the curious legends of Madagascar, as translated faithfully by Mr. Baker, the contributor of the specimen of the poetry of that island printed in our number for March.

Remarks on the intercourse of the western nations of antiquity with India, by Mr. E. Stirling.

The papers connected with the abstract of the subsequent portion of the *Kah-gyur* were laid on the table ; of which an analysis by the Secretary was presented at the last meeting ; (printed in the present No.)

The thanks of the Society were voted for the above.

#### VI.—MISCELLANEOUS INTELLIGENCE.

##### 1.—*Extract of a letter from Lieut. Alex. Burnes, dated Balkh, 11th June, 1832.*

"On leaving India, I had resolved to avoid the Town of Khúl'm, in the territories of the Uzbek chief of Kúndúz, who placed Mr. Moorcroft's party under contribution to the amount of 25,000 rupees, but by the urgent advice of a most influential man at Kabúl we joined a party who were to pass that town, since they were supposed to have influence at Kúndúz. The result was, that we were forthwith put under surveillance, and reported to the chief, who summoned us to his presence. Leaving all my party behind me, as well as Dr. Gerard, I proceeded to Kúndúz, and personified the character of a poor Armenian, by profession a watch-maker, who was proceeding to Bokhara. Múrad Bég was deceived ; but I must add, that I first came to a private understanding with his custom-house officers to keep me in countenance. You may imagine, I did not wait long at Kúndúz, but mounting my horse, rode 70 miles at one stretch, and 40 on the following day, to this city, where we are beyond the reach of all such désagrémens. As I finish this, our caravan is just starting for Bokhara, which we shall reach in fourteen days.

Our journey across the Hindú Kúsh was most exciting : it is a fearful undertaking, but with a judicious choice of season presents no barrier to the passage of an army, if accompanied by a *horde* of pioneers. The great range of the Indian Caucasus, i. e. the prolongation of the Himalaya, has been placed erroneously in our maps to the north, instead of the south of Bamán. None of the passes were higher than 12,000 feet, as water boiled on them at 192° and 193°, [Bar. 19.72 and 20.15 inches,] but some of the peaks cannot be under 20,000 feet. There are six passes between Kabúl and Khúl'm. The formations of the three first differed widely from those farther north, and which are lower. South of Bamán we had iron, blue mica slate, and quartz, and from the higher hills blocks of granite had been precipitated from above. North of Bamán, at the pass of *Dundan Shikun*, or the tooth-breaker, the formation changed into ash-coloured limestone, and continued so till we left the mountains. Once across the mountains we wound among terrific defiles and dells, the different courses of the water. Some of these rose to a height

of 2000 perpendicular feet over our heads, and were such as to hide the sun from our view. What a country for a geologist ! The Hindú Kush is almost destitute of vegetation ; but the *asafetida* plant grows in great exuberance, and forms the principal pasture of the flocks, which browse over them.

We have now fairly debouched into the plains of Tartary, but we have no plateau or elevated land, as seems to have been imagined by some geographers to exist in these regions. Here water boils at  $209\frac{1}{2}^{\circ}$  [= (Bar. 28.40 inches)], and before we reach Peshawer, since we follow the Oxus, it must even rise. This climate is considered insalubrious, but it looks a very nice place, and produces the most delicious fruit: the apricots are as large as small apples, with the mellowest flavour.

You must not suppose, that we took the route of the Hindú Kush in our journey to this place, but followed the grand caravanserai. The Hindú Kush is but the name of one pass over these mountains, and though it is the highest of all the practicable passes and is only traversable for three months in the year, it is described as the best road. Twenty horsemen may go abreast on it, but the snow is eternal, and it is a three days journey without grass, wood, or supply. It must be very high, since men and animals all experience a difficulty of breathing. There appears to be a phenomenon of nature in this mountain, which deserves mention—I allude to snow-worms. They are described to be as large as a silk-worm before it begins its cocoon, and white and transparent ; they die on being separated from the snow."

#### 2.—*Lithontrity practised in Persia.*

The following notice of a method of breaking up a stone in the bladder is extracted from the *Ahwâs-ul-hejër*, an anonymous Persian translation of a treatise on the properties of minerals, composed in the Arabic language ; the date of the work is not known, but it is accounted ancient. Were the spirit of the author to appear before the Académie at Paris, we know not whether it might not become a claimant for a share of the Monthyon prize of six thousand francs lately adjudged to M. Leroy, for his various lithontritic instruments. The passage occurs in describing the qualities of the diamond.

"One of its properties is to reduce urinary calculi to powder, and it is used in this way :—a diamond of the size of a grain is fastened firmly to a kind of probe of copper (ميل *mil*, an instrument used for applying collyrium) with mastich or lac, which probe is then brought in contact with the calculus and rubbed upon it until the stone is broken to pieces, when it is voided with the urine."

#### 3.—*Extract from a letter from Major Burney, Resident in Ava, to Mr. Swinton, dated Rangoon, 24th August, 1832.*

"I lately discovered in the 21st volume of the Burmese History, that the Cholera is no new disease in this country. In the year 1706, it raged in the city of Ava, and destroyed a great many of the inhabitants. The Burmese History, in which I find this account, is said to have been compiled before the Talain conquest of Ava in 1751, and the copy of the work which I possess is marked as having been transcribed in the year 1790. These are the words in the original. "On Thursday, the 14th day of the waning moon of *Katshoun* (our April), in the Burmese year 1068 (A. D. 1706), past six o'clock in the evening, the whole of the golden city was seized with panic, and made a great uproar, shouting and beating with sticks. And from this month of *Katshoun* the whole city of Ava suffered from purging and vomiting, and a great many persons died of the *Kála-na*, or Kala sickness." The above is a literal translation of the passage. The Burmese still

call the Cholera *Kála-na*, which means sickness that comes occasionally. About four years ago this dreadful scourge appeared in this town of Rangoon and carried off 3,500 of its inhabitants.

*4.—Rain at Churra Punyi, registered by W. Cracroft, Esq.*

| 1832.        | inches.   | July 12  | inches.   | August 6 | inches.   |
|--------------|-----------|----------|-----------|----------|-----------|
| June 1 to 17 | 6.45      | 13       | 0.450     | 7        | 5.805     |
| 18           | 2.24      | 14       | 1.150     | 8        | 0.937     |
| 19           | 1.40      | 15       | 1.420     | 9        | 0.680     |
| 20           | 4.91      | 16       | 5.169     | 10       | 1.987     |
| 21           | 4.76      | 17       | 7.597     | 11       | 1.155     |
| 22           | 1.04      | 18       | 5.250     | 12       | 0.517     |
| 23           | not meas. | 19       | 5.860     | 13       | 0.0       |
| 24           | 1.04      | 20       | 3.390     | 14       | 0.060     |
| 25           | 2.39      | 21       | 0.701     | 15       | 0.915     |
| 26           | 2.22      | 22       | not meas. | 16       | 1.150     |
| 27           | 0.0       | 23       | do.       | 17       | 0.407     |
| 28           | 0.0       | 24       | 2.490     | 18       | 0.765     |
| 29           | 1.85      | 25       | not meas. | 19       | 0.0       |
| 30           | 1.40      | 26       | 4.869     | 20       | 7.812     |
| July 1       | 1.95      | 27       | 0.0       | 21       | 2.862     |
| 2            | 1.83      | 28       | 0.0       | 22       | 4.420     |
| 3            | 2.12      | 29       | 1.350     | 23       | 1.595     |
| 4            | 4.57      | 30       | 1.355     | 24       | 2.425     |
| 5            | 9.73      | 31       | 0.0       | 25       | not meas. |
| 6            | 4.11      | August 1 | 2.642     | 26       | 1.087     |
| 7            | 1.33      | 2        | not meas. | 27       | 2.650     |
| 8            | 1.837     | 3        | 2.715     | 28       | 2.170     |
| 9            | 1.217     | 4        | 2.862     | 29       | 2.050     |
| 10           | 0.0       | 5        | 2.690     | 30       | 0.405     |
| 11           | 1.287     |          | not meas. | 31       | 2.265     |

For 16 days of June, 28.58 inches.

In July, 73.724

In Aug. 52.386

Total rain 154.690

For the first 22 days, the measurements were taken by means of a glass bottle and funnel:—afterwards, by an accurately constructed tin pluviometer.

*5.—Method of ascertaining the Humidity of the Soil, from an Arabic work,—communicated by Mulvi Abdúl Mijid.*

“ I find in a book of Agriculture, that if any one wish to know the proximity or distance of water, he is to dig three or four cubits in the earth, then to take a pot of brass, or a pitcher of earth, and besmear the inside evenly with fat ; let the pot have a wide mouth, and when the sun sets, let him take a quantity of white wool, combed and washed, and a stone of the size of an egg ; wrap this wool round it like a ball, and moistening the side of the ball with melted wax, attach it to the bottom of the pot already smeared with grease, then throw it to the bottom of the hole that has been dug, so that the wool will be dependent, and the wax will retain it, and it will be dependent to the place of the stone\* : then pile upon

\* This passage is unintelligible in the original : it means apparently that the pot shall be placed in an inverted position in the well, so that the stone enclosed in the cotton and attached to the bottom of the earthen vessel with wax, shall hang in an insulated position in the hollow space ; any moisture rising from the ground would thus be deposited in minute drops upon the cotton.

it earth to the height of one or two cubits, and leave it during the whole night, and when it is morning, before the rising of the sun, scrape the earth from it, and lift up the vessel, and if the water is seen adhering to the vessel within, in many drops, near to each other, and the wool filled (with it), there is water in this place, and it is near; and if the drops be not collected (together), and not near each other, and the quantity of water in the wool be moderate, then the water is neither very far off nor very near; and if the drops be adherent and separated from each other, and there be little water in the wool, then the water is distant; and if there be seen no drops in the vessel, neither large nor small, and there be no water in the wool, then there is no water in the place, and it is useless to dig it. I find also in some copies of agricultural works upon this subject, that he who wishes to know this matter is to examine the ants' nests, and if he find the ants thick, black, and slow in their motions, let him consider, and as slow as are their motions, so near is water to them, and if the ants are quick in their motions, it is not near; and the water is 40 cubits from them; and the water in the first case is sweet and good, and in the second is heavy and salt: and this paragraph is for him who desires to find water, and we have explained this in detail in our book the *Akhbar-uzzamán*, and have only mentioned here what necessity requires as a hint on the subject, without any detail or explanation." T.

#### 6. *Mirage in India.*

It is not generally known that the mirage, apparently first brought to the notice of modern Europeans by the French army in Egypt, is visible in the central parts of Hindústan. In Rajpútana it is necessarily of constant occurrence; but in the less arid plains to the eastward it is also to be seen. At Ghazípur, between the European bazar and the stables of the Company's stud, there is a level, extending about a mile; from the east end of which may very often be seen, about half a degree under the western horizon, the appearance of a sheet of water about 1° in width and perhaps 10° in length from right to left, in which the sky, houses, trees, and animals are reflected as in a bright mirror.

D. B.

#### 7. *Hará Miná, or Green Basalt, used for coloring Stucco.*

The rock in which the caves of Ellora are excavated is stated by Captain TWENLOW, Bombay Artillery, to be a basaltic trap, which from its green tinge, and its different stages from hardness to disintegration, is supposed by the natives to be full of *vegetable* matter in a greater or less advance to petrification. The crumbling rock affords a natural green color, which is ground up and employed by the natives in painting on wet chunam: it is called *hará miná*, or green enamel, probably because when exposed to heat it fuses into a dark bottle-green glass.

CHAPTAL, the chemist, introduced in France a method of making glass bottles with pulverulent basalt, either alone or mixed with sand and ashes. The above substance might doubtless be employed for the purpose, were there sufficient inducement to set up an establishment of the kind.

#### 8. *On the Converging Beams of Light which are occasionally seen opposite to the Sun.*

"This phenomenon is always seen opposite to the sun and generally at the same time with the phenomenon of diverging beams, as if another sun, diametrically opposite to the real one, were below the horizon, and throwing out his divergent beams." In a phenomenon of this kind which I saw in 1824, the eastern portion of the horizon where it appeared was occupied with a black cloud, which seems to be necessary as a ground for rendering visible such feeble radiations.

"This phenomenon is entirely one of perspective. Let us suppose beams inclined to one another like the meridians of a globe to diverge from the sun, as these meridians diverge from the north pole of the globe, and let us suppose that planes pass through all these meridians, and through the line joining the observer and the sun, or their common intersection. An eye, therefore, placed in that line, or in the common intersection of all the fifteen planes, will see the fifteen beams converging to a point opposite to the sun, just as an eye in the axis of a globe would see all the fifteen meridians of the globe converge to its south pole."

Having observed in Sir David Brewster's treatise on optics (published last year in Lardner's Cyclopædia), the above repetition of his usual account of a beautiful appearance which frequently adorns our Indian evenings, and having always thought his explanation of it deficient in the clearness and truth which generally characterize his writings, I shall venture to suggest another mode of illustration:

The diverging beams which to us appear to radiate from the sun when obscured by broken masses of cloud are in fact, as a consequence of the sun's enormous distance, sensibly parallel to each other. It need hardly be remarked that in permeating the atmosphere they do not proceed in straight lines, but are more or less inflected towards the earth. This inflection being disregarded, they may be considered as a series of elongated parallel prisms, extending perhaps  $50^\circ$  to the north and south of the zenith, at the height of a few thousand feet. The beam which crosses the zenith will have to the spectator the same appearance as the sky seen from the centre of a long narrow street of lofty houses: at the zenith it will have its greatest breadth, and it will taper and appear to descend towards the sun and opposite point of the heavens, and the same will happen with all the other beams lying north and south of it; whence they will appear to converge.

I may remark, that the phenomenon is incomparably more vivid in this climate than in Britain, that it is frequently and most clearly seen when there is not a visible cloud except the few masses in the west which produce the necessary obstruction of the solar rays, and that the beams can be traced across the whole concave in alternate shades of the purest light and dark blue. D. B.

#### 9. Errors in Dr. Arnott's Physics, Second Volume.

In the first volume of the GLEANINGS IN SCIENCE I remarked on some mistakes which disfigure Dr. Arnott's excellent Elements of Physics; and the first part of the second volume of the latter work having recently reached me, I would beg to direct the author's attention to the following slight blemishes, which might, if uncorrected, affect its otherwise well sustained character:

The most serious mistake is in his theory of the camera lucida, at p. 301: the eye does not see the paper "through" the prism but beyond its edge, the plane in which lie the line of sight and the edge of the prism bisecting the pupil.

At p. 218 he states that if the insertion of the optic nerves were at corresponding parts of the eyes, a black spot would always be seen in the field of vision;—forgetting that when only one eye is open no black spot appears. Why no black spot in this case appears is as yet unexplained.

At p. 194 he represents as a straight line a ray of light passing obliquely through the centre of a lens.

At p. 157 he states that "the inhabitants of India, where the thermometer sometimes stands at  $115^\circ$  in the shade, have their blood no higher than  $98^\circ$ ." Dr. John Dary from numerous experiments concluded, that blood heat in tropical countries is raised to  $100^\circ$  during the hot season.



At p. 102 he repeats his erroneous theory of the artificial formation of ice in India,—“by evaporation and a current of air;” while the former circumstance is unnecessary to the process, and the latter always fatal to it. Radiation is the principle.

D. B.

10. *Silver Mines discovered in Cuba. By Don Ramon de la Sagra, Superintendent of the Botanic Garden at the Havana.*

(From the “*Anales de Ciencias, Agricultura, Comercia o Artes*” of May, 1828.)

When towards the end of 1826, I began a course of lectures on mineralogy and geology, it was my object to induce attention to the mineral productions of the Island of Cuba, and they had the effect of procuring me numerous contributions of specimens from various districts. About the same time Don Jose de Escalante, an inhabitant of Villa Clara, being well acquainted with the mines of Peru and Mexico, employed himself in exploring and examining the minerals of that neighbourhood, and he succeeded in discovering, first, several veins of copper, and afterwards a mine of silver, which he has claimed (*denunciado*) in the usual form. The specimens of minerals submitted by him, were sent to me for analysis by His Excellency the Intendant; and the following is the result; the silver being separated by amalgamation.

|                          |           |
|--------------------------|-----------|
| Iron,                    | 67.81     |
| Silver,                  | 0.48      |
| Silex and Alumina,       | 9.7       |
| Loss in gases and water, | 21.98     |
|                          | <hr/> 100 |

The mineral is found in mass; of an earthy ferruginous appearance; friable on the surface, but compact within; of a grey metallic colour; texture granular, sometimes laminous; fracture irregular and rough, with a few bright specks; fluate of lime makes no impression; but the ore is easily scratched by rock crystal; yields a reddish powder,—not magnetic: its specific gravity is 2.25; easily dissolved by nitric and hydrochloric acid; and also by weak sulphuric acid, which disengages much hydrogen gas. When dissolved, prussian-blue may be precipitated abundantly with hydroferrocyanate of potash. Infusible with the blowpipe, which converts the ore into black scoria. Hence I class the mineral among the ochreous iron-stone, or the *Ochriger roth Eisenstein*, of the Germans.

According to Geological reports of the mines in Peru, most of the silver from that country is extracted from ore of iron clay. In Mexico also, there are mines worked in the province of Oajaca the ore of which has a similar appearance, being composed of grey iron with native silver disseminated in the mass, not perceptible to the eye. Humboldt remarks, that, both in Mexico and in Peru the masses of oxide of iron which contain silver are found in the upper part of the veins near the surface of the earth; which is a good sign as regards Senor Escalante's discovery.

According to the report of the discoverer, the mine occupies a great extent of ground on the slope of a hill; but he is ignorant of the width and depth of the vein. A mine which yields  $7\frac{1}{2}$  ounces of silver to the quintal of ore, if the ore be abundant and of easy access and separation, is a treasure worthy the attention of government and of enterprising individuals. Should the mass of mineral prove as considerable as Senor Escalante asserts, the mine of Villa Clara will be one of the most valuable in America, on account of the proportion of metal which it contains, and the very simple process required to extract it.

The researches of Don Fausto del Elhuyar, whose fame is so well established in the history of science and of the mining art, shew that the mean produce of all the mines of Mexico does not exceed 18 to 25 parts of silver in 10,000, which is equal to 3 or 4 ounces per quintal (100 lbs.) The calculations of Senor Garrés give less than 2 ounces per quintal for the mean produce of all America. The great vein of Guanaxuato, the most valuable in the world, has yielded only an average return of 4 ounces per quintal. The proportion of  $7\frac{1}{2}$  ounces found in the ore from Villa Clara is therefore remarkable; but not less so is the great facility with which I obtained the metal, by a first experiment, without any guide to regulate the quantity of salt and the proportion of quicksilver, best suited to form the amalgam, which nevertheless was formed within a few hours after throwing in the mercury. It is also to be observed that no "magistral" (precipitant?) was employed, which is usually indispensable.

A subsequent article by the same writer, dated January 1829, states that no other silver mine had been discovered, and that the working of that of Don Jose de Escalante had made little progress up to that date. G.

#### 11. *Supposed Change of Climate of the Northern Parts of the Earth.*

Our readers are aware, that the opinion of the northern parts of our earth, having formerly possessed a much warmer climate than at present, has been adopted and supported by many naturalists and geologists. The proof of this fact is supposed to be found in the remains of vegetables and of animals, the inhabitants of warm countries, being now found in the rock formations of colder climates. Dr. Fleming, who was the first to shew the weak points of the much talked of speco-diluvian hypothesis of Dr. Buckland, has now taken up the subject of the remains of animals. His opinion is, that the discovery of the remains of a species in any rock formation is no ground for inferring, that the other species of that genus must have been also inhabitants of the same country. He considers, that unless the same species are found in our rocks, which at present inhabit warm countries, nothing certain can be concluded; as an instance how much analogy may mislead us in this question, he mentions, the genus *Equus*, the species of which are sufficiently separated in geographical distribution. In like manner he brings forward the elephant, the remains of which found in Siberia have been pronounced by Cuvier to be very probably those of an animal that inhabited a cold country. Analogy is certainly a powerful instrument in the search after truth, but it is to mistake its nature and use altogether, to apply it to the direct establishment of dogmas. It can only guide our enquiries; at most it may shed a ray of light upon our path, and enable us to distinguish and seize the particular truth we are in search of: but it would be to confound all science, to suppose that every analogy is a truth. Analogy cannot be made the foundation of a fact; but it may form sufficient grounds for enquiring if that fact be true or otherwise.

Dr. Fleming's paper is in answer to Mr. Conybeare, and taken with the former on Dr. Buckland's deluge, proves him to be an antagonist every way worthy of attention. Both the papers contain detections and refutations of that loose analogical inference, for reasoning it cannot be called, which is the bane of true science. H.

#### 12. *Limestone Formation.*

Professor Sedgwick, in his communications to the Geological Society, of 1831, has shown, that the mountain limestone of the north of England consists essentially of

two groups, the "great scar limestone" is the lower, having an average thickness of more than 500 feet, and containing orthocerata, trilobites, and ammonites. The younger group contains five beds of limestone, of which the highest or "12 fathom limestone" is associated with many strata of sandstone and shale, and 3 or 4 seams of workable coal. The whole of this calcareous system is overlaid by a complex group connected with the millstone grit, and interlaced with beds of shale, and one or two seams of coal. From his general conclusions we learn, that the carbonaceous formations become much more calcareous in their range to the north—that from the nature of the associated organic remains, coal has, in some places, been produced in deep seas, and in other places in shallow estuaries,—that changes in the mineral character of the contemporaneously formed strata are usually accompanied by changes in the species of the fossils, whether animal or vegetable—and lastly, that the valleys in the carboniferous chain, near the lines of section, are not fissures which have been deepened by erosion, but true valleys of denudation.

### 13. *Correction of a mistake in the notice on Marine Surveys.*

In page 333, line 4, where mentioning, that the sextant is used for taking the relative positions of points on shore, it was said that "the azimuth compass was resorted to only for laying down the true meridian." Every surveyor will see, that this must be an inaccuracy, as such determinations would ill accord with the exactitude obtained by the other parts of the operation. The sentence should have run thus ;—"azimuths taken with the sextant between the limb of the setting or rising sun and some fixed object on the horizon, as an island or peak, afforded the means of determining the true meridian." Such we know to be the method practised by Captain Ross.

## VII.—*Progress of European Science.*

### MECHANICS.

#### 1. *Steam Carriages.*

The introduction of steam carriages on the turnpike roads of England may now be considered as established : this grand improvement has broken its way through the difficulties opposed to it—in the nature of the machinery,—the varying resistances and levels of the roadway,—the prejudices of the public against its dangers and inconveniences, and the strenuous opposition of the stage-coach proprietors, and of the toll trustees, whose prohibitory increase of charge has been finally levelled by an Act of Parliament, if not passed, at least brought up by the chairman of the Select Committee appointed to inquire into the subject of steam carriages, and consequently not likely to be negatived.

This great achievement in mechanics has prevailed through two irresistible practical arguments : 1st, journeys from London to Bath and Southampton have been performed, and 2nd, a great saving of expence to travellers has been certified.

The following extract from the "Report" shews the progress already made :

"The first extensive trial of steam as an agent in draught on common roads, was that by Mr. GURNEY, in 1829, who travelled from London to Bath and back in his steam carriage. He states, that although a part of the machinery, which brings

both the propelling wheels into action, when the full power of the engine is required, was broken at the outset, yet that on his return he performed the last 84 miles from Melksham to Crawford Bridge in 10 hours, including stoppages. Mr. GURNEY has given to the committee very full details of the form and power of his engine, which will be found in his evidence. The committee have also examined Messrs. SUMMERS and OGLE, Mr. HANCOCK and Mr. STONE, whose steam carriages have been in daily use for some months past on common roads. It is very satisfactory to find, that although the boilers of several engines described vary most materially in form, yet that each has been found fully to answer the expectation of its inventor; so well in fact have their experiments succeeded, that in each case, where the proprietors have ceased to use them, it has only been for the purpose of constructing more perfect carriages, in order to engage more extensively in the business.

When we consider that these trials have been made under the most unfavourable circumstances, at great expense, in total uncertainty, without any of those guides which experience has given to other branches of engineering,—that those engaged in making them are persons looking solely to their own interests, and not theorists, attempting the perfection of ingenious modes; when we find them convinced after long experience that they are now introducing such a mode of conveyance as shall tempt the public by its superior advantages from the use of the admirable lines of coaches which have been generally established, it surely cannot be contended that the introduction of steam carriages on common roads is merely an uncertain experiment unworthy of legislative attention.

Beside the carriages already described, Mr. GURNEY has been informed, that from twenty to forty others are being built by different persons, all of which have been occasioned by his decided journey in 1829.

The committee have great pleasure in calling the attention of the house to the evidence of Mr. FAREY. His opinions are the more valuable from his uniting, in so great a degree, scientific knowledge to a practical acquaintance with the subject under consideration. He states, that he “has no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of steam carriages;” and again, “that what has been done proves to his satisfaction, the practicability of propelling stage coaches (by steam) on good common roads, in tolerably level parts of the country, without horses, at a speed of 8 or 10 miles per hour.”

Much of course must remain to be done in improving their efficiency, yet Mr. GURNEY states that he has kept up steadily the rate of 12 miles per hour; that the “extreme rate at which he has run is between 20 and 30 miles an hour.”

Mr. HANCOCK “reckons that with his carriage he could keep up a speed of 10 miles per hour without injury to the machine.”

Mr. OGLE states, “that his experimental carriage went from London to Southampton in some places at a velocity of from 30 to 35 miles an hour.”

“That they have ascended a hill, rising 1 in 6, at 16½ miles an hour, and four miles of the London road, at the rate of 24½ miles per hour, loaded with people.

“That his engine is capable of carrying three tons weight in addition to its own.”

Mr. SUMMERS adds, “that they have travelled in the carriage at the rate of 15 miles per hour with 19 persons in the carriage up a hill 1 in 12.

“That he has continued for 4½ hours to travel at the rate of 30 miles per hour.

"That he has found no difficulty in travelling over the worst and most hilly roads."

Mr. JAMES SROSE states, "that 36 persons have been carried in one steam carriage. That the engine drew 5 times its own weight, nearly at the rate of from 5 to 6 miles per hour, partly up an inclination."

The several witnesses have estimated the probable saving of expense to the public from the substitution of steam-power for that of horses at from one half to two-thirds. Mr. FAREY gives, as his opinion, "that steam coaches will very soon after their first establishment be run for one-third of the cost of the present stage coaches."

The advantages of steam-power are not confined to the greater velocity gained or to its greater cheapness than horse draught ---

"There is no danger of being run away with; and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles an hour, in case they are frightened or choose to run away; and for quick travelling they must be kept in that state of courage, that they are always inclined for running away, particularly down hills, and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable and capable of exerting its power in reverse in going down hills. Every witness examined has given the fullest evidence of the perfect control which the conductor has over the movement of the carriage. With the slightest exertion they can be stopped or turned, under circumstances where horses would be totally unmanageable."

The danger of explosion has been greatly reduced by adopting the tube form of boiler, and further benefit is expected from some ingenious modifications of Mr. TREVITHICK.

The questions of frightening the horses of other carriages, of inconvenience from smoke and steam, are also disposed of by the committee; but they are of too trivial a nature to need comment, and we know that steam carriages have passed over London bridge in the midst of vehicles of all denominations.

The mass of evidence taken before the committee is of a most valuable nature, but for this we must refer our readers to the printed report, or to the *Mechanic's Magazine* for 1831, selecting only a few notes therefrom.

Mr. GURNEY's boilers are of cast-iron tube: he works them up to 100 lbs. on the square inch. On plain ground, one wheel, on hilly or slippery, two wheels are connected with the working crank: the facility of stopping by throwing the steam on the opposite side of the piston is so great, that if going 8 miles an hour, a carriage can be brought up within 6 or 7 yards: it can turn in a circle of 10 feet. When moving at a slower rate than 4 miles an hour, the expense of fuel is greater than that of horses. The evaporation of 9 gallons of water per hour is equivalent to one horse power: Mr. GURNEY prefers coke as a fuel, and thinks smoke cannot be consumed without separation of the carbonic acid gas, by passing through lime or other means: considers explosions not always attributable to steam, but frequently to formation of explosive compounds of hydrogen and oxygen, as does GAY LUSSAC.

To provide for accidents from the guide falling asleep, he has contrived that the valves of the engine shall only remain in gear while he is awake and at his post. The moment he takes his foot off, the engine stops: the same contrivance

prevents the carriage running down hill too rapidly, and there is no occasion for drags.

Mr. J. FUREY, engineer, thinks the carriage for conveyance should be upon the same wheels with the engine, to give firmer adherence to the road; approves of the ejection of the waste steam in a stream upwards through a contracted orifice at the bottom of the chimney (introduced by Mr. STEPHENSON on the rail-way engines), as it increases the draught, which from the necessity of a short flue cannot be maintained otherwise, without fans, blowers, or bellows. However Mr. SUMMERS and other engineers object to this plan, as the contracted orifice of the steam escape takes away proportionally from its power on the other side of the piston.

The vertical jet gives such an intensity of draught as was never procured before, and with the further advantage, that the rapidity of draught so produced increases whenever the engines work faster and discharge more steam. This may be considered a very important improvement, as is another described by Mr. R. TREVITHICK regarding the construction of boilers. This engineer has taken out a patent for an entirely new engine, wherein the fire-place, boiler, and condenser stand perpendicularly one within the other: they are formed of six wrought iron tubes. One charge of *distilled water* only is required; the steam being condensed and returned into the boiler by a force pump. To supply the waste by leakage a small apparatus is used, which effectually prevents any fluctuation in the height of water in the boiler, or the collection of sediment, and consequent danger of the boiler becoming heated red-hot.

The boiler is not only less than any other but stronger, and if it were worked at the same pressure as the portable gas-holders, theory would give a saving of fuel, weight, and room over low pressure engines of sixteen to one.

Mr. DAVIES GILBERT explains the apparent anomaly, that with steam power increase of velocity does not enhance expence\*.

It was last year determined by the society of civil engineers, that the expence of conveying carriages drawn by horses was at its minimum, when the rate of travelling equalled about three miles an hour; and that expence increased up to the practical limit of speed nearly as the velocity; while on the contrary, friction being a given quantity, as well as the force necessary for impelling a given weight up a given ascent, the power required for moving steam carriages on a rail-way remains theoretically independent of its speed, and practically increases a very little in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c.

The expenditure of what may be called efficiency is as the actual force multiplied by the velocity, and the consumption of fuel in a given time will be in the same proportion; but the time of performing a given distance being inversely as the velocity, the expenditure of fuel in a given time will be constant for a given distance; and it is very nearly so in practice.

\* This is the case on land, where friction is constant, but on water the very reverse takes place; for the resistance to motion in fluids increases much more rapidly than the velocity: thus the same expenditure of steam (or coal) that will carry a steamer alone a certain distance, with a given velocity, will with a sacrifice of only  $\frac{1}{2}$  of time, convey her with a large ship astern to the same distance. Vide GLEANINGS, III. 158.

Mr. JAMES M'ADAM acquaints us with the fact of the legislature having obliged the tires of all wheels to be free from projecting knobs or nails—a great improvement; he looks to great benefit to the roads from dispensing with horses: weigh bridges are now universally abolished, the effect of carts upon roads being mainly proportionate to the number of horses, according to which the toll is now levied.

Mr. JOHN MACNEILL furnished a variety of very useful experimental tables of the pressure of various carriages upon an inch surface of road;—the weight necessary for their draught with different velocities and on different inclinations;—and the expence per mile for the same. The experiments of the second table were conducted under Mr. TELFORD, with a machine invented by his assistant Mr. MACNEILL for measuring the force of traction, or the labour of horses in drawing carriages. The following are the general results in a tabular form.

*Results of experiments made with a stage-coach, weighing, exclusive of passengers, 18 cwt. on the same piece of ground with different inclinations.*

| Inclination. | Rate of travelling. | Force required. | Expence of drawing one ton per mile in a waggon at 2½ miles per hour.              |
|--------------|---------------------|-----------------|--|
| 1 in 20      | 6 miles             | 268 lbs.        | <i>pence.</i><br>22.83   |
| 1 in 26      | 6 "                 | 213             |  |
| 1 in 30      | 6 "                 | 165             | 18.55  |
| 1 in 40      | 6 "                 | 160             | 16.79  |
| 1 in 600     | 6 "                 | 111             | 12.66  |
| horizontal   |                     |                 | 12.36  |
| 1 in 20      | 8 "                 | 296             | [Expence of drawing one ton per mile in a four-horse stage, at 10 miles per hour.] |
| 1 in 26      | 8 "                 | 219             |  |
| 1 in 30      | 8 "                 | 196             |  |
| 1 in 40      | 8 "                 | 166             |  |
| 1 in 600     | 8 "                 | 120             |  |
|              |                     |                 | <i>d.</i>  |
| 1 in 20      | 10 "                | 318             | 50.47  |
| 1 in 26      | 10 "                | 225             |  |
| 1 in 30      | 10 "                | 200             | 44.15  |
| 1 in 40      | 10 "                | 172             | 41.25  |
| 1 in 600     | 10 "                | 128             | 33.59  |
| horizontal   | 10 "                | ?               | 32.93  |

The following are the same engineer's accurate measures of traction, or resistance, on different qualities of road, which are directly opposed to M'ADAM's theory of road-making, as applied to cities, though not to country.

- 1.—On well-made pavement, the draught (of each horse?) in a waggon weighing about 21 cwt. is ..... 33 lbs.
- 2.—On a broken stone surface or old flint road, ..... 65
- 3.—On a gravel road, ..... 147
- 4.—On a broken stone road upon a rough pavement foundation, 46
- 5.—On a broken stone surface upon a bottom of concrete, formed of Parker's cement and gravel, ..... 46

No description is given of Mr. MACNEILL'S dynamometer, but Mr. TELFORD speaks of it in great commendation.

# *Metereological Register, kept at the Surrey General's Office, Calcutta, for the Month of September, 1832.*

| Minimum Temperature<br>observed at sunrise. |        |                                 |     |                        |     |                           |      |       |       | Maximum Pressure<br>observed at 9h. 30m. |      |                        |     |                        |     |                           |      |       |    | Max. Temp. and Direction<br>observed at 2h. 40m. |      |                        |     |                        |     |                           |      |       |    | Minimum Pressure<br>observed at 10. 0m. |      |                        |     |                        |     |                           |      |       |    | Observations made at<br>sunset. |      |                       |     |                       |     |      |      |     |    | Observations in Valentia<br>at 10½ P. M. |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |     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|---|--------|---------------------------------|-----|------------------------|-----|---------------------------|------|-------|-------|--|------|------------------------|-----|------------------------|-----|---------------------------|------|-------|----|--|------|------------------------|-----|------------------------|-----|---------------------------|------|-------|----|---|------|------------------------|-----|------------------------|-----|---------------------------|------|-------|----|---------------------------------|------|-----------------------|-----|-----------------------|-----|------|------|-----|----|--|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|------|------|-----|----|-----|---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| Days of the<br>Month.                       |        | Barometer<br>reduced to<br>32°. |     | Temper.<br>of the air. |     | Depres.<br>of M. B. Ther. |      | Wind. |       | Aspect of<br>the sky.                    |      | Barom.<br>red. to 32°. |     | Temper.<br>of the air. |     | Depres.<br>of M. B. Ther. |      | Wind. |    | Aspect of<br>the sky.                            |      | Barom.<br>red. to 32°. |     | Temper.<br>of the air. |     | Depres.<br>of M. B. Ther. |      | Wind. |    | Aspect of<br>the sky.                   |      | Barom.<br>red. to 32°. |     | Temper.<br>of the air. |     | Depres.<br>of M. B. Ther. |      | Wind. |    | Aspect of<br>the sky.           |      | Rain Gauge,<br>No. 1. |     | Rain Gauge,<br>No. 2. |     |      |      |     |    |  |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |     |    |     |      |      |   |
| 1   | 29.472 | 81.3                            | 1.1 | n. e.                  | cu. | 53.3                      | 86.5 | 5.5   | n. e. | cus.                                     | 44.5 | 87.7                   | 7.8 | n.                     | cu. | 44.5                      | 87.7 | 7.8   | n. | cu.  | 44.5 | 87.7                   | 7.8 | n.                     | cu. | 44.5                      | 87.7 | 7.8   | n. | cu.                                     | 44.5 | 87.7                   | 7.8 | n.                     | cu. | 44.5                      | 87.7 | 7.8   | n. | cu.                             | 44.5 | 87.7                  | 7.8 | n.                    | cu. | 44.5 | 87.7 | 7.8 | n. | cu.                                      | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7.8 | n. | cu. | 44.5 | 87.7 | 7 |

*Alphabetically.* In the column "wind" small letters have been used instead of capitals: *cu.* means *cloudy*; *cl.* *clear*; *m.* *rain*; *ci.* *cirrus*; *cu.* *cumulus*; *cs.* *cirro-stratus*; *cus.* *cumulo-stratus*; *cc.* *cirro-uniformis*; *n.* *nebula*.



# JOURNAL

## THE ASIATIC SOCIETY.

No. 10.—October, 1832.

I.—*Analysis of the Vishnu Purána.* By H. H. Wilson, Sec. As. Soc.

The *Vishnu Purána*, as may be inferred from its appellation, is eminently *Vaishnava*, and considers *VISHNÚ* one with the Supreme Being, *PARAMA BRAHMA*, and *PARAMÁ'TMA*'.

It is supposed to be related by *PARÁSARA*, the grandson of *VASISHT'HA*, to his disciple *MAITREYA*, and dispenses with the usual machinery of *Suta* and the *Rishis*: it is said in the first chapter, indeed, in the form of a prophetic enunciation by *VASISHT'HA*, that *PARÁSARA* is the author of the *Samhitá* and the *Puránas*.

In other chapters, however, it is again asserted, that *DWAIPÁYANA VYÁSA* is the author of all the *Puránas*, and to reconcile these two statements recourse is had to a statement in the 3rd chapter of the 3rd section. It is said, that there is a *VYÁSA* or *VEDA VYÁSA* in every *Dwápar Yuga* of the *Vaivaswat Manwantara*; of this *Manwantara* we are now in the 28th *Kali*: accordingly, 28 *Dwápar Yugas* have elapsed, and 28 *Veda Vyásas* have existed; the last is *KRISHNA DWAIPAYANA*, or the person usually designated as *VYÁSA*. *PARÁSARA* was the 26th *VYÁSA*, and this *Purána* is consequently the work of a preceding *Maháyuga*, or aggregate of four ages. The *Agni Purána* states *PARÁSARA* to be the author of the *Vishnu Purána*. In the classification adopted by itself, (book 3rd, chapter 6,) it is placed the third; after the *Brahma* and *Padma*.

This *Purána* is divided into six *Ansus*, books or sections, each being sub-divided into a varying number of *Adhyáyas* or chapters: it does not follow the order prescribed by the usual definition of a *Purána*, but deviates less widely than most of these compositions: according to the *Agni Purána*, it contains 25,000 *slokas*. A com-

mentary on this *Purāna* exists, but of no great value, except as explanatory of some of the philosophical passages

The first book opens with the dialogue between MAITREYA and PARĀSARA, as already noticed. PARĀSARA states himself to be the son of SAKTI, the son of VASISHT'HA. Buchanan, from the *B'hāgavat*, makes him the son of UPAMANYU and grandson of SAKTI, but the *Mahābhārat* confirms the authority of the *Purāna*. "The son of SAKTI (PARĀSARA) next arrived there with his disciples." The passage of the *B'hāgavat* on which Buchanan's statement rests, has not been found; the Bengali manuscripts generally read *Sakti* instead of *Sakti*.

Buchanan has also noticed the incompatibility of PARĀSARA's genealogy with his being, as it is stated, cotemporary with SANTANU king of *Hastinapur*, that prince being the 44th in descent from ATRI, who is cotemporary with VASISHT'HA, who again is but three generations anterior to PARĀSARA; he supposes therefore, that many generations in the line of VASISHT'HA must have been omitted. It is not necessary, however, to attempt to reconcile these incongruities, for the coetaneous existence of ATRI and VASISHT'HA is less chronological than mythological, or, perhaps, as they are both enumerated amongst the stars of the great bear, astronomical; it extends throughout the *Manvantara*: their immediate successors, who hold a sacred character, enjoy a like longevity, and are similarly cotemporary at any period with their ancestry and posterity: if we consider them as mere mortals, we must suppose, that PARĀSARA preceded the great war by three generations, KRISHNA DWAIPĀYANA, his son, being the father of DHRTARĀSHTRA, PANDU and VIDURA by the widow of VICHITRAVIRYA. VYĀSA was however cotemporary with his grandson and their descendants, agreeably to the above system of saintly immortality. Mr. Bentley places PARĀSARA about 575 B. C. (Hindú astronomy), Buchanan about 1300 B. C. (Genealogies of the Hindús), and Wilford 1391 (A. R. ix. 87.)

The first chapters of the first book of the *Vishnu Purāna* contain an account of the creation, ascribing it to the association of VISHNU with PRADHĀNA and PURUSHĀ, matter and spirit, or the female and male, or passive and active energies. During the intervals of creation, VISHNU exists independant of all connexion or attributes, and is beyond the comprehension of human faculties. When disposed to create the universe, the elements, properties, and senses generated by the two sensible combinations of the deity are collected into an egg floating on the water, in which VISHNU again, as BRAHMĀ, is concealed, and

from which he issues to separate, and arrange the constituent portions of the world : the system is therefore perfectly conformable to that anciently entertained as explained in the opening of *MENU*, substituting *VISHNU* for *BRAHMA*.

• The third chapter contains the usual divisions of time, from the twinkling of an eye to the period of a *Kalpa*; the fourth, an account of the *Varāha Avatāra*, whence the *Varāha Kalpa*, or actual great period, derives its appellation. In the 5th chapter we have the series of creations, effected by *VISHNU*, amounting to nine, followed by a more detailed account of the order in which the several classes of beings sprang into existence, extending through the 6th and 7th chapters.

The seventh chapter brings us to the creation of the chief characters of the *Sṣayambhūsa Manvantara*, the account of whose family is in part at least obviously an allegory. *Sṣayambhūva*, the son of the self-existent, is married to *SATARUPĀ*, (the hundred or many-formed, the great mother :) their children are two sons, *PRIVĀNARĀ* (the lover of devotion), and *URTĀNAPĀDA* (where we are at fault), and two daughters, *PRASUTI* (child-bearing) and *AKUTI\**, a name not admitting an obvious allegorical etymology. It may be observed, that the *Bhāgavat* adds a third daughter, *DEVĀHUTI* (invocation of the gods), married to *KERDAMA* (soil or sin); *AKUTI* was married to *RUCHI* (light), a *Prajapati*, but not included in the usual enumeration of those sons of *BRAHMA*, unless he be the same with *MARICHI*; their offspring were *YAJNA* (sacrifice), and *DAKṢHINĀ* (donation), who, though brother and sister, were married and begot the twelve divinities called *Yānas*, a class whose character and office are not known. *PRASUTI* was married to the *Prajapati* *DAKṢHA* (ability or power); they had twenty-four daughters, all emblematical, *SRĀDDHĀ*, (faith,) *LAḶṢMI*, (prosperity,) *DHṢṢITI*, (fortitude,) *TUṢṢITI*, (content,) *PUSṢITI*, (satiety,) *MEḶḶĀ*, (apprehension,) *KṢṢIYĀ*, (action, &c.); thirteen were married to *DHṢṢMA*, (equity :) of the other eleven nine were married to the nine *Rishis*, *SVĀḶḶĀ* (oblation) was wedded to fire, and the collective *PITṢṢIS* or progenitors had *Sṣrāddhā*, the funeral sacrifice, for their spouse : their posterity are all of the same significant character, as their appellations satisfactorily indicate. The *Purānas*, in general, follow this account of the first race of created beings, with some modifications and additions : the *Bhāgavat*, as we shall hereafter see, has supplied the most copious accessions, and has introduced into the series

\* However another reading often occurs, usually considered, it is true, an error of the copyist, but possibly the right reading; *ĀNUṢṢITI*, invocation of the gods, prayer, or sacrifice.

a degree of perplexity and inconsistency that are quite foreign to the simplicity of the *Vishnu Purāna*, in which we may therefore conceive the primitive notion is most faithfully represented.

The churning of the ocean for the recovery of *Sri* and *Amrita* or ambrosia, lost to the gods in consequence of the anger of *Durvāsas* with *Indra*, is narrated in the ninth chapter, but more concisely than usual. The posterity of the *Rishis* by the daughters of *DAKSHA* follow, and we have then a long episode relating to *DHRUVA*, the second son of *UTTĀNAPĀDA*, who, for his devotion to *VISHNU*, was elevated to the dignity of the polar star.

The descendants of *DHRUVA* are traced in the 13th chapter to the 6th *MENU CHĀKSHUSHA*, and from him by *URU*, *ANGA*, and *VENA* to *PRITHU*, from whom the earth was named *Prithivi*: the fourth descent from *PRITHU*, consisted of the ten *PRĀCHETASAS*, and their son was *DAKSHA* the *Prajāpati* in a new birth: this is the father of the 60 daughters, of whom 27 were the constellations, the lunar mansions, or wives of the moon, and thirteen the wives of *KASYAPA*, by whom the gods and demons, men and animals, were produced. The remaining chapters of this section contain the accounts in detail of the origin of these races, from the daughters of *DAKSHA* married to *KASYAPA*. The original refers these in the 21st chapter to the *Swārochisha Manwantara*, but this is irreconcilable with the descent of *DAKSHA*, as before mentioned from *Chākshusha Menu*, and as again stated in the third book. This section of the *Purāna* terminates with the division of the universe under its respective regents, and praises of *VISHNU* as the Supreme Being.

The second book contains the usual account of the division of the earth into *Dwīpas*, and the formation of the seven *Pātālas*, and *Naraka*, with the situation and course of the planets and the description of their several cars: that of the sun is very fully and curiously detailed: the last chapters give a legendary account of *Bharata*, the object of which is to inculcate the supremacy of *VISHNU*, and the unreality of worldly existence, agreeably to the doctrines of the *Vedānta* philosophy.

The third book of the *Vishnu Purāna* should have formed, agreeably to the systematic classification of the contents of a *Purāna*, its fourth, treating of the reigns of the different *Menus* and their descendants: the detail however is little more than a bare enumeration of names, the appellation of the *Menu*, the *INDRA*, or king of the gods, the *Ganas* or classes of *Devas*, the seven *Rishis*, and the sons of the *Menu*, and who are all distinct in each *Manwantara*. Those of the

first, sixth, and seventh periods are of the most note. In the intermediate ones little of interest occurs, and less in those that are to come. We may therefore here insert the names of the persons of these three *Manwantaras*.

|          |                      |                              |                        |
|----------|----------------------|------------------------------|------------------------|
| MENU.    | <i>Swayamb'hura.</i> | <i>Chākusha.</i>             | <i>Vairasu at.</i>     |
| INDRA.   |                      | <i>Manajara.</i>             | <i>Purandhara.</i>     |
| DEVATAS. |                      | <i>Adyas.</i>                | <i>Adityas.</i>        |
|          |                      | <i>Prasutas.</i>             | <i>Vasus.</i>          |
|          |                      | <i>Bharyas.</i>              | <i>Rudras, &amp;c.</i> |
|          |                      | <i>Prithugas.</i>            |                        |
|          |                      | <i>Mahanubhavas, &amp;c.</i> |                        |
| RISHIS.  | <i>Marichi.</i>      | <i>Somedhi.</i>              | <i>Vasishth'ha.</i>    |
|          | <i>Angiras.</i>      | <i>Viraja.</i>               | <i>Kasyapa.</i>        |
|          | <i>Atri.</i>         | <i>Havishmat.</i>            | <i>Atvi.</i>           |
|          | <i>Fulastya.</i>     | <i>Uttama.</i>               | <i>Jamadagni</i>       |
|          | <i>Pulaha.</i>       | <i>Madhu.</i>                | <i>Gautama.</i>        |
|          | <i>Kratu.</i>        | <i>Atenaman.</i>             | <i>Vishwamitra.</i>    |
|          | <i>Vasishth'ha.</i>  | <i>Sakishna.</i>             | <i>Bharadhwaj</i>      |
| SONS.    | <i>Priyavrata.</i>   | <i>Uru.</i>                  | <i>Ishwāku.</i>        |
|          | <i>Uttanapada.</i>   | <i>Puru.</i>                 | <i>Nab'haga.</i>       |
|          |                      | <i>Satadru.</i>              | <i>Dhrishna.</i>       |
|          |                      | <i>Tapaswi.</i>              | <i>Sanyati.</i>        |
|          |                      | <i>Satyavati.</i>            | <i>Narishyanta.</i>    |
|          |                      | <i>Suchi.</i>                | <i>Bhāgadheya.</i>     |
|          |                      | <i>Agnishthoma.</i>          | <i>Karusha.</i>        |
|          |                      | <i>Sadyumna.</i>             | <i>Prishadhra.</i>     |
|          |                      | <i>Abhimanyu.</i>            | <i>Vasumat.</i>        |
|          |                      | <i>Atiratra.</i>             |                        |

In this manner the persons of the remaining seven *Manwantaras* are prophetically detailed.

In the next chapter of the third section occurs the enumeration of the 28 *Veda Vyāsas* already alluded to. In the *Dwāpar* age of every *Mahāyug*, or aggregate of four *Yugas*, a *Muni* or sage appears, who makes a new arrangement of these works, and is therefore called *Vyāsa* or *Veda Vyāsa*. The *Vyāsa* of the present period is KRISHNA DWAIPĀYANA, the son of PARĀSARA, and the twenty-eighth of the series, and who, according to this authority, and the sectarial notions it advocates, is a minor descent or incarnation of VISHNU himself.

The origin of the *Vedas* and *Purānas* is treated of in the next chapter of this section, with many curious details. The *Veda*, it is said, was originally a ritual, containing ample instructions for the five great sacrifices, or oblations to fire, at the full and change of the moon, and in every fourth month, the offering of animals, and libation with the juice of the acid *Asclepias*; these five being doubled as *Prakriti* and

*Vikriti*, or simple and modified, became ten, and these were the objects of the *Vedas*.

The mode in which *Vyāsa* is described as arranging the *Veda*, implies its prior existence in separate portions, as he called to his assistance four persons, severally acquainted with them, or *Paila* for the *Rik*, *Vaisampāyana* for the *Yajur*, *Jaimini* for the *Sāma*, and *Sumanta* for the *Atharvan*. The description is not very clear, but it should seem that he made a kind of digest of the whole collectively, which he again separated according to the purport of the different passages; the *Rik*, containing the *Richas*, or prayers used with oblations by the *Hotri*, or officiating priest; the *Yajur*, comprising the formula of the rite repeated by the *Adhvaryu*; the *Sāma*, composed of the hymns chanted by the *Udgātā*; and the *Atharvan* comprehending prayers and rites suitable for princes or the military order, repeated or conducted by the *Brahmans* on their behalf.

The *Vishnu Purāna* then describes the different *Sanhitās*, or collections of the prayers and formulæ of each *Veda*, and their respective authors. The *Rig* was divided into two *Sanhitās*, by *PAILA*, who taught one to *INDRAPRAMATI* and the other to *VASHIKALA*; each of these and their disciples made further subdivisions. The *Yajur* was divided into 27 *Sākhās* by *VAISAMPĀYANA*, besides the other great portion of it obtained from the sun, by *YAJÑAWALKYA*, which subsequently branched into fifteen divisions. The *Sāma* and *Atharvan* are in a like manner extensively subdivided. The whole of these details are curious, and indicate a period long forgotten, when the *Vedas* were extensively studied: the names derived from the subdivisions, as *Taittiri*, *Vaji*, &c. still designate tribes of *Brahmans* in some parts of India, but few of any of the separate *Sanhitās* are procurable. Mr. Colebrooke has made use of these sections of the *Vishnu Purāna* in his account of the *Vedas*. (A. R. Vol. viii.)

The origin of the *Purānas* is here also ascribed indirectly to various individuals. *Vyāsa* is said to have compiled the *Purāna Sanhitā*, but he gave it to *SUTA* or *LOMAHERSHANA*, who had six disciples, *SUMATI*, *AGNIVERCHCHĪĀ*, *MAITREYA*, *SINAPĀYANA*, *KASYAPA*, and *SĀVARNI*; and to them *SUTA* delivered six *Sanhitās*. Three of the disciples, *SINAPĀYANA*, *KASYAPA*, and *SĀVARNI*, composed *Sanhitās*, also called *Mula Sanhitā*, and *ROMAHERSHANA* compiled another. The *Vishnu Purāna*, again, it may be inferred is a subsequent compilation, as it is said to contain the substance of these four works. A list of the *Purānas* is then given as usual, omitting the *Vāyu* from the

The remainder of the section is occupied with the detail of the duties of the different tribes and orders, and terminates with an absurd legend called the *Yama Gitā*, the scope of which is to shew, that the spirits of those who have faith in *Viṣṇu*, are not to be approached by the messengers of the infernal monarch; it must be admitted, however, that compared with the other *Purānas*, the *Vishnu Purāna* does not very frequently offend with legendary insipidities of this description.

The fourth section contains the genealogies of the royal families, commencing with the lines of the sun and moon, and terminating with the kings of the *Kālī* age, until a modern period. This section has furnished the greater part of the materials with which Sir William Jones, Mr. Bentley, and Colonel Wilford, attempted to adjust the historical chronology of the *Hindūs*; the latter (*A. R.* Vol. ix.) gives the *Vishnu Purāna* as one of his authorities; the first cites a list furnished by his *Pandit*, but it is the same thing with one or two inaccuracies; as an example of these may be stated what he asserts of the four *Kanwa* princes, that they reigned 345 years, whence Sir William Jones observes, that the generations of men and reigns of kings are extended beyond the course of nature even in the present age (*A. R.* ii. 143.)

Adverting to the same circumstance, Mr. Bentley refers (vol. v. page 324,) the extravagant elongation of the reigns of these princes, to a deliberate attempt to fill up a chasm occasioned by placing the descendants of *Janamejaya* at too early a period, and cites this as one of the innumerable absurdities of the modern *Hindūs*.

Colonel Wilford again observes, these *Kanwas* are said to have reigned 345 years, which is still more extravagant. (Vol. ix. page 110.)

It would scarcely be supposed, that these assertions are all founded on error. In the early stage of Sir William Jones's enquiries, his trusting to his *Pandit's* authority, may be excused; but it seems very doubtful whether Mr. Bentley or Colonel Wilford took the pains to verify that statement. At any rate, in four manuscripts of the *Vishnu Purāna*, two in the *Deranagari* and two in the Bengalee character, instead of 345 years, the term of the united reigns of the four *Kanwa* princes is stated to be 45 years, a period neither extravagant nor absurd, nor beyond the course of nature.

The ancient dynasties of kings anterior to the *Kālī* age, within the bounds of which they should no doubt be brought, can scarcely be adjusted with much consistency or satisfaction; at the same time this is a consideration rather favourable to their authenticity, as had they been the result of a systematic fabrication, they would easily have

been adapted to some fixed periods, and to each other. That many inaccuracies and some falsifications have crept into these genealogies may be readily admitted; but there is no good reason to dispute the actual existence of the principal individuals commemorated, nor the general course of their ancestry or descendants. That their memory was preserved by some means anterior to the *Puránas* is established by the *Vishnu Purána*. Reference is made in it repeatedly to former traditions, and old verses are cited as illustrative of the history or character of a number of the princes of whom mention is made. (Sections 8, 10, 11, 12, 13, 19, &c.)

The 11th and following chapters of this book, to the 15th, contain a detailed account of the descendants of YADU. A curious story is interwoven into the portion that relates to KRISHNA, of his being falsely accused of having stolen a marvellous gem, the possession of which secured wealth and prosperity to its possessor, if virtuous. It was given to SATRAJIT, the cotemporary, very inconsistently it must be confessed, of KRISHNA, and his sixth ancestor, and a member of the YÁDAVA family. Apprehending KRISHNA's requiring the gem, SATRAJIT gave it to his brother, who was killed in the forest by a lion. KRISHNA hunting killed the lion and found the jewel; he returned it to SATRAJIT, who gave him in requital his daughter in marriage: this led to further family dissensions, in which KRISHNA was accused by his own brother of having under-handedly appropriated the gem to himself: he, at last, however, cleared himself in an assembly of the *Yádavas*, and the jewel became the undisputed property of his relative AKRURA. In these transactions, the character of KRISHNA, although heightened with marvels, is of a very earthly complexion; and as to BALARÁMA, it is said of him by KRISHNA, that he is unfit to be master of the jewel, because he drinks wine, and is addicted to sensual pleasures. With respect to the gem, its properties of procuring plenty to the country of its possessor, and of bringing down rain when needed, ally it to the marvellous stone, for the acquisition of which, the *Tartar* tribes not unfrequently had recourse to hostilities.

In detailing the lists of *Magadha* kings, the *Vishnu Purána* states, that from the birth of PARIKSHIT to the coronation of NANDA, 1015 years elapsed. NANDA preceded CHANDRAGUPTA 100 years, and CHANDRAGUPTA, as identified with SANDROKOPUS, ascended the throne 315 B. C. PARIKSHIT was the grandson of ARJUNA, consequently the war of the *Mahábharat* occurred 1430 years before the Christian era. Wilford reduces this by 60 years, and places the conclusion of the



great war 1370 B. C., the difference is not very material, and either date may present an approximation to the truth.

From CHANDRAGUPTA to the accession of the ANDHRA princes, three dynasties occupy an interval of 294 years: the ANDHRAS therefore commenced their rule about 20 years before Christ, which will agree well enough with the account of the power of the Andra, as given by Pliny, about the end of the first century of our era. According to the *Purāna*, there were 30 princes, who reigned 456 years, which brings them to A. D. 436. Colonel Wilford has endeavoured to extend them, however, to the seventh century, identifying the last or *Pulomarshi* with the Pouloumien of the Chinese Annals, who died in 648, according to De Guignes. (As. Res. ix. 87.) If this is correct, the ANDHRA dynasty must be imperfectly given. The commencement being corroborated by Pliny, is apparently accurate, but we want two centuries at the termination. Wilford proposes to supply part of the deficiency, which is less in his statement, by inserting seven princes, whom he calls genuine ANDHRAS, before the ANDHRABHITYAS; but there is no warrant for this, and the number is inadequate to the interval required. There is however evident confusion here in our authority, the text and comment state expressly that the dynasty is composed of 30 princes, and yet even with the repetition of the name *Satakarni* five times, although it is probably intended in most cases as a title, we have but 27 names. Wilford's list, indeed, contains but 25 names. It is likely, therefore, that some of the names have been lost; and if we can suppose the dynasty to have comprised nearer 40 than 30 princes, we may extend the time of PULIMAN, so as to be the same with that of Pouloumien.

There is another identification in this list with the Chinese history, which may be even more readily adjusted than the preceding. The annals of China record that in 408 ambassadors arrived from Yuegnai, king of *Kiapili* in India, the *Kapilu* of the *Bauddhas*, to which possibly the authority of the Magadha prince as Lord paramount extended. The name of the prince is clearly YAJNA, and we have a YAJNA SRI the 24th of the ANDHRA kings. Agreeably to the commencement of the race 20 years B. C. and the average of reigns authorised by the text, 15 years and five months, YAJNA SRI reigned about 330, or only 78 years earlier than he appears in the Chinese accounts. If indeed, as is allowable, we consider him to be the 27th prince, being the third before the last, then the agreement is almost precise; as he will have reigned from 375 to 390, and we have only to suppose his reign one of those above the

average amount, to bring him to the year 408 ; these identifications, however, whether made out precisely or not, bear favourable testimony to the accuracy of the *Hindu* lists, as to the existence of the individuals about the time specified : we can scarcely expect a close concurrence in the annals of different nations, at best imperfectly known to each other.

The succession of races which follows the *ANDHRAS* is evidently confused and imperfect ; seven distinct dynasties are detailed, extending through 1390 years, and two others through a period of 406 years : 47 princes of different tribes succeed them, to whom less than four centuries cannot be ascribed, the whole throwing the last of the *ANDHRAS* back 2190 years, and computing that 4055 years of the *Kali* age had elapsed : the last periods, grafted probably, as Colonel Wilford has supposed, on the coetaneous existence of different dynasties at undefined intervals, are in all likelihood calculated to fill up the years expired of the *Kali* age, and so furnish a clue to the date of this *Purāna* : if 4055 years of *Kali* had passed when the work was completed, it was written 870 years ago, or in the year 954.

The notices that follow would present an interesting picture of the political distribution of India at the date at which it may be supposed the author wrote, if the passages were less obscure : as it is, considerable uncertainty pervades the description. It appears from it that the *Kshetriya* rule was very generally abolished, and that individuals of various castes, from *Brahmans* to *Pulindas* (mountaineers or foresters) reigned in *Magadha* or Behar, at Allahabad, at *Mathurā*, *Kāntipurī*, *Kāsipurī* or *Kanyapurī*, probably Benares or Kanouj, and in *Anugangam* or *Gangetic* Hindoostan. The *Guptas*, a term indicating a *Sudra* family, reigned over part of *Magadha*, and *Devarakshita*, an individual so named, over the maritime provinces of *Kalinga*, &c. the *Guhas* in another part of *Kalinga*, the *Manidhanas* in the *Naimishu*, *Naishada*, and *Kalatoya* countries, or the districts to the east of Benares and Bengal. *Sudras*, and cowherds ruled in *Surat*, in *Mewar*, along the *Nermada* and at *Ougein* ; and *Mlechchhas* possessed the country along the *Indus*, along the *Chandrabhāgā*, or in the *Punjab*, *Dārāvika*, and *Cashmīr* : this last statement is corroborative of the accuracy of the detail, as well as of the date assigned to the composition, as although in the middle of the tenth century, the Ghaznvide princes had not occupied *Cashmīr*, yet they had extended their influence along the *Indus*, and into the upper parts of the *Punjab*.

The fifth book is appropriated to the history of *KRISHNA*, and is possibly a graft of more recent date than the original. Although the

story is told in the usual strain, yet there is this peculiarity, that KRISHNA is never considered as one and the same with HARI ; he is only an *Ānsāvatura* or an incarnate portion of VISHNU ; not a very distinguished one either, being only one of VISHNU's hairs (B. v. chapter 1.) plucked off by himself at the prayers of the gods, to become incarnate in the conception of *Devaki*, to be born for the purpose of alleviating the distresses of the earth.

The subsequent occurrences are related conformably to the tenor of the *B'hāgavat*, and very differently, therefore, from that of the *Bhārat* ; the war with JARASANDHA particularly, and the adventures of KĀLA YAVANA : it also includes what may be supposed to typify some hostile struggles between the followers of SIVA and VISHNU, in the personal conflict between KRISHNA, and the former, as taking part respectively with ANIRUDDHA and BANASURA.

From the 34th chapter of this section, we learn that there have been spurious KRISHNAS amongst the *Hindus*, and PAUNDRAKA, the king of Benares, is described as usurping the title of *Vāsudeva* : he is encountered by the legitimate possessor of the name, defeated and slain : his son continues the war with the aid of SANKARA or the SAIVAS, and it should appear at first with some success, so as to endanger *Dvārakā*, the capital of KRISHNA : the allies however are repelled, and the holy city *Kasī* burnt by the relentless discus of the victor ; the legend seems to delineate, though darkly, actual occurrences.

This book terminates with the destruction of the *Kūdavas* ; KRISHNA's being shot through mistake by a forester, and his ascent to heaven.

The last book of the *Vishnu Purāna*, after describing the divisions of time into *Kalpas*, &c. expatiates on the various pangs that flesh is heir to, and directs mankind to the only remedy for them, faith in VISHNU as the Supreme.

The general character of the *Vishnu Purāna* will be readily conceived from this sketch of its contents : it is a sectarial work, but of a much more sober character than such works generally possess, and appropriates to legend and panegyric, a comparatively insignificant portion of its contents : the geographical and astronomical systems to be found in it, are of the usually absurd complexion, but they are more succinctly and perspicuously described than perhaps in any other *Purānas* : the same may be said of the genealogies, and the fourth book, may be regarded as a valuable epitome of the ancient history of the *Hindūs*.

The date of the compilation, it has already been observed, may be inferred to be as low as the middle of the tenth century : there are no

other grounds for specifying the date, but the *Purāna* is clearly subsequent to the development of the whole body of Hindú literature : the *Vedas* and their divisions are particularised, the names of all the *Purānas* are given as usual, and reference is repeatedly made to the *Itihāsa* and *Dharma Śāstras*. In the fourth section of the third book also PARÁSARA says, Who but NĀRĀYANA can be the author of the *Mahābhārat* ? It is consequently posterior to that work, in common it is most probable with all the *Purānas*. Notwithstanding this recent origin, however, the *Vishnu Purāna* is a valuable compilation, particularly in its being obviously and avowedly derived from more ancient materials.

## II.—*On the Standard Weights of England and India.*

The Westminster Review, No. 31, contains an able article on the imperfections of the system of measures and weights adopted by the legislature in England, upon the report of the parliamentary commission in 1825.

The reviewer justly remarks, that the fear of innovation seems to have curbed the free exercise of judgment by the commissioners, so that in fact, after all their deliberations, they did little more than settle the discrepancies of various standards to the thousandth part of a grain, and lop off four and a half grains from the avoirdupois pound ! In most other respects the country is left in as much confusion as before, with two kinds of lineal measure ;—two kinds of superficial measure ;—three kinds of cubic measure ;—and not only two kinds of weight, but these so exquisitely varied, that the larger pound has the smaller ounce !

In lieu of so perplexing and anomalous a state of things, the reviewer proposes to substitute a system founded on a simple and a rational basis : viz.—that some fixed length, a foot for instance, shall be taken as the unit of lineal measure ; that the square of this shall become the unit of superficial measure ; and the cube, the unit of solid measure. We do not propose at present to advert to his arguments on the inconveniences of our numerous linear and square measures,—but on the subject of weights, we will endeavour to show the kind of system which he represents as capable of formation out of materials at hand, with only such little modifications as would not practically be felt in the ordinary affairs of commerce.

He first premises as a maxim of utility, that the current coin of the country should be closely connected with the weights ; accord-

ingly,—the pound of standard silver being coined into 66 shillings in England, it is evident that 11 crown pieces weigh 10 oz. troy, leaving a very simple ratio for the conversion of one into the other : the crown (436.36 grs.) is also nearly equal in weight to the avoirdupois ounce (437½ grs.) and might be substituted for it practically without much inconvenience : moreover, 1000 crowns are exactly equal in weight to a cubic foot of distilled water at the temperature of 15° cent. (59° Fahr.) (43636.3 grs.)

From these data, it becomes a very easy problem to frame a system of weights, measures, and coin connected together in simple ratios, uniting all the benefits of decimal numeration, and still maintaining tolerable accordance with the weights now in use. To give a general idea of the combination proposed, without entering into its details, we present the following scheme alongside of the existing system.

| <i>Proposed Crown Weights.</i> | <i>Weight in crown grs.</i> | <i>Weight in troy grs.</i> | <i>Remarks.</i>   |
|--------------------------------|-----------------------------|----------------------------|---|
| One crown grain. . .           | 1                           | 0.91                       | one troy grain = 1.1 crown grain.                       |
| 20 gr. = 1 scruple. . .        | 20                          | 18.18                      |   |
| 3 sc. = 1 dram. . .            | 60                          | 54.54                      |   |
| 8 dr. = 1 oz. (or cr.) . .     | 180                         | 163.63                     | the avoird. oz. now is 437.5 tr. gr. or 181.25 cr. gr.) |
| 16 oz. = 1 pound. . .          | 7680                        | 9681.82                    | ditto ditto, lbs. 7000 .. or 7700 ..                    |
| 100 lb. = c. lb. . . .         | 768000                      | 698182                     | (the cwt. av. wgs. now 784000 or 862400 .. )            |
| 500 lb. = 1 qr. ton. . .       |                             |                            | tr. gr. cr. gr.   |
| 2000 lb. = 1 ton. . .          |                             | 13963636                   | (the ton weighs now 15680000 or 17248000)               |

*Measures of Capacity.*

- 1 oz. = 1 cubic digit (or 0.1<sup>3</sup> foot) = the proposed liquid ounce.  
 1000 oz. = 1 cubic foot of distilled water, at 59° Fahr. or 15° cent.  
 10 oz. marked x = ½ pint.  
 20 oz. marked xx = 1 pint.  
 40 oz. marked xxxx = 1 quart.  
 160 oz. = ONE GALLON (the present imperial gallon = 10 lb. av. or 10 cr. lb. + 200 c.g.)  
 8000 oz. = 500 lbs. = 1 hogshhead = 50 gallons = 8 cubic feet = cube of 2 feet.  
 1000 lbs. = 1 pipe = 100 gallons = 16 ditto.  
 2000 lbs. = 1 ton or TUN = 200 gallons = 32 ditto.

It must be confessed, that the higher numbers in this scheme both of liquid and solid weights are too much at variance to obtain easily a footing in commerce, and in many respects as good a system might have been framed with the preservation of one only of the pounds and the present troy grain.

The most fortunate hit in the scheme of the reviewer is in the fortuitous circumstance of 1000 crown pieces, of our present coin, counterbalancing precisely a cubic foot of pure water at 59°. A fact worth carrying in the memory, at any rate, for although five shilling pieces are but rarely seen in currency now-a-days, it may be convenient for

those who experimentalize upon water in regard to evaporation, rain, discharge of pipes, and the like, to know that they carry a *decimal divisor* of the *liquid foot* in their pocket. But the crown piece of our coinage is already allied to the pound troy, as the coin must always be by the very provision that the "pound troy shall be coined into so many shillings or aliquot parts." The pound troy then is actually the standard unit of weight and coinage, and however plausible a scheme may be brought forward, unless it adheres to some such fixed point of very general prevalence, it may be looked upon as merely speculative, and not likely to gain admittance among practical men.

The troy pound is coined exactly into sixty-six shillings. The troy ounce therefore weighs 5s. 6d. without any fraction. The weights of every other coin, and the value of all the other systems of weights used in commerce, such as the avoirdupois, the liquid measure, &c. are expressed in terms of the troy grain, which is nothing but a subdivision of the *troy pound unit*, so that although a multiplicity of standards has been made up for preservation and comparison, this alone is entitled to the name of STANDARD. It was to simplify the connection of the avoirdupois weight in relation to the latter that it was changed from  $7004\frac{1}{2}$  to 7000 grains; the latter number however is almost as irrational as the former, and it would have been far better to have expunged the anomalous avoirdupois weight altogether; or, if it were thought absolutely necessary to preserve a heavy weight, a *pakka wazn* as the natives of India would call it, it might have been made one-third heavier than the troy pound, or 7680 grs.:—this would have been divisible by 16 into an ounce identical with the troy ounce, and when multiplied by 100, for the *hundred weight*, would have given a weight (of 7680000 grs.) nearly equal to the present clumsy cwt. of 112 av. lbs. or 7840000 grs. and equally applicable to all the wholesale operations of commerce, without necessitating any change of the customs charged on the gross weight, or even affecting the price-current of most commodities in the market.

But it is useless at this time, and at this distance from the scene of its operation, to comment upon a system now irrevocably adopted. It must ever be regretted, that a scheme of such national importance did not chance to fall under review under the ministry so eminent in science as the present Lord Chancellor of England.

The subject was brought to our notice principally by a measure now in agitation before the Government of British India, for the adoption of some law respecting the weights and measures of this country, in which at present so great a confusion prevails that it is almost im-

possible to say what is the recognized standard in either, even at the presidency itself.

The Indian system, when the English first became acquainted with it, combined all the advantages of a direct connection between the coin and the unit of weight\*. They were in fact the same thing, until the regulation taking force from the 1st January, 1819, changed the standard purity of the coin by an addition of copper, without altering its value in pure contents of silver. This measure increased the weight of the rupee by an awkward fraction of  $\frac{1}{16}$  parts, and rendered all subsequent conversions of weight into money a matter of intricate calculation; for the old rupee was still retained as the unit of weight under the title of *sicca weight*, in contradistinction to the newly introduced *sicca rupee*: and it was allowed still to regulate the weight of the bazar maund, which was forty seer of eighty siccas each.

Subsequent changes in the upper provinces and in the other presidencies have had similar effects of introducing new weights, and although the object aimed at by the home Government has been all along that of equalizing the whole, yet, for want of a common basis to proceed upon, and of due combination in carrying their measures into effect, nothing more has been attained than mere approximations, as perplexing to the admirer of uniformity as the original system itself. It would lead us into lengthy observations to explain the steps taken at each place, to bring about an accordance of the several rupees to that ordered by the Court to be made the standard of India; and as our object is to shew how all may become even now amalgamated into one system, connected directly with the standard of England, it will suffice to state, what our materials are at the present moment:

| <i>Appellation.</i>   | <i>Weight in troy grains.</i>         |
|---|---------------------------------------|
| Calcutta sicca rupee, .....   | 191.916 gold mohur, 204.710           |
| — sicca weight, .....   | 179,666                               |
| Lucknow rupee, in weight, .....   | 172.101 (value in Standard 180.705)   |
| Furukhabad rupee, used as a weight up to the country, where the old weight has disappeared, ..... | 180.234                               |
| Sonat Rupee, (nominal,) ....  | 183.644                               |
| Madras and Sagur rupee and weight, ....   | 180.000 (Madras mohur 180)            |
| Bombay Rupee, in weight, (since ordered to be made 180 as at Madras,) ..                          | 179.000 but in Standard value 179.642 |

\* The genuine Indian *weights* were the *jo* or barleycorn, the *rati*, *masa*, and *tola*:  $7\frac{1}{2}$  jo = 1 rati: 8 ratis = 1 masa = 17.708 grs. 12 masa = 1 tola = 2125 grs. but these are now become obsolete, and are only known to jewellers, or beyond the provinces under British rule.

|   |                                      |
|---|--------------------------------------|
| Bazar maund at Calcutta, .....          | 82 lbs. 2 oz. 2.055 dr. avoirdupois. |
| ———— at Benares, .....                  | 82 lbs. 6 oz. 5.9                    |
| Salt maund of 82 siccas to the seer, .. | 84 lbs. 203. 15.7 drs.               |
| Factory maund, .....                    | 74 lbs. 10 oz. 10.666                |
| Madras candy of 20 maunds, .....        | 500 lbs. the md. = 24 lbs. 2 oz.     |
| Bombay ditto of 20 ditto, .. .....      | 560 lbs. 28 lbs.                     |

The Calcutta or pakka maund is also used at the latter place, and in bullion is received at the Madras and Bombay mints by the pound *troy*, as it is in England : in purchases of native produce, bazar weights are used, which vary in almost every different district : in transactions with the Company's commercial agents, the factory maund is employed ; in salt purchases a maund of 82 siccas to the seer ; opium is sold in packages of 133 to 140 lbs. to suit the Chinese *pikal* weight ; while again for exportation to Europe, English cwts. or lbs. must be entered in the invoice, so that in one merchant's godown there are generally not less than three species of weights, and it is matter of experience, that continual mistakes will occur in their use, unless, as is seldom the case, they are marked in very legible characters, intelligible not only to Europeans, but also to the native weighmen.

It was not long since a case occurred in which the weights of a commercial establishment were found to be in error eight or ten per cent. : it may be very fairly supposed, that this proceeded from the confusion of the weights of different systems, although it must be acknowledged, that a skilful *podar* would very soon perceive differences of such large amount, and if he were inclined to take fraudulent advantage of them, could do so without much risk of discovery. It has been at times source of complaint, that the receipt and delivery weighments at the custom-house are at variance ; in short, if it be desired to clear away all suspicions of wilful or accidental error, and to simplify to the utmost the transactions of commerce, it can only be done by adopting one system of weight ; abolishing all others by common consent, and establishing means of adjustment and verification accessible to all parties.

We shall now offer a few hints on the system which appears most eligible from its simplicity, its connection with existing things, and its ready adjustment to the standard system of Great Britain ; our reason for doing so, through these pages, in the first instance, rather than in a direct appeal to the proper authorities, where we have every reason to know they would meet with proper consideration is, that the question is one of universal interest, and, where the convenience of the public is concerned, the more such a measure is canvassed, the more likely will it be to have its faults and objections pointed out, and improvements, either radical or collateral, suggested.



1. At first view, it is obvious, that the Calcutta sicca weight, so called, (179.666 grs.) and the several rupees (or weights) of the upper provinces, and of the Madras and Bombay presidencies, though not identical (varying from 180.7 to 179 grs.) may be made to coincide, without the slightest effect upon commercial proceedings and a number of small perplexing difficulties may thus be avoided.

2. The advantage of assuming in even numbers 180 grains for the sicca weight of all India would be equally obvious in dealings with England, both in coin and in goods : for the bazar maund, being 40 seers of 80 siccas each, would be equal to 576000 grains, or precisely 100 of the standard troy pound of Great Britain. The difference from its present weight would be a little short of ten sicca weight, or two *chitaks*, a quantity far too small to be influential ; and if a number of weights were at once adjusted on such a system, they might be dispersed throughout the country, and introduced at once, without disturbing the public mind by any talk of innovation. The seer weight would be exactly equal to  $2\frac{1}{2}$  pounds ; the pound troy would equal 32 sicca weight ;  $2\frac{3}{4}$  British Indian rupees would weigh 1 oz. ; and 1 rupee would weigh  $7\frac{1}{2}$  dwt.

With regard to the connection of the maund with the avoirdupois weight, of course a simple relation could not be formed : in practice it would remain nearly *in statu quo* ; in theory it will be at any more simply connected than at present in the ratio of  $82\frac{2}{3}$  to  $82\frac{7}{10}$ , or 82 lbs. 2 oz. 2.055 drs. ; the maund would represent  $82\frac{1}{2}$  lbs. aver. within a trifling fraction.

3. Should it be necessary to retain the Calcutta sicca rupee, which has, at present, by law, the weight of 191.916 grs. troy, this fraction might with great convenience be made at once 192 grs. or exactly  $\frac{1}{5}$  in excess of the proposed sicca weight, so that the up-country rupee would be precisely equal to 15 annas, instead of having a small fractional difference as at present. Thirty sicca rupees would then weigh 1 lb. troy, and, if the standard were the same, would be equivalent in value to 86 shillings, the rupee being  $= 2\frac{2}{10}$  shillings.

Regarding the difference of standard alluded to, we would fain say a few words, although the subject may prove too technical for general readers to follow. The Indian standard of silver contains  $\frac{1}{2}$  of alloy : English standard silver has contained by law ever since the time of William the Conqueror 18 dwts. in the pound, or  $\frac{1}{20}$ , being  $\frac{1}{250}$ th purer than that of India. Until the last year, however, on account of an error in the ancient Parliamentary standard plates of England,

the coin of both countries has been coined  $1\frac{1}{4}$  dwts. too fine, so that in reality our Indian coin has been only  $\frac{3}{4}$  dwts. worse, or almost equal to the English legal standard. Now, that the error has been corrected at home, and has been brought to the notice of the proper officers here, with a view to the introduction of a similar correction, would it not be far simpler to equalize the two standards at once by raising our purity  $\frac{3}{4}$  dwt., instead of lowering it  $1\frac{1}{4}$ , and making it differ from almost every coin on the globe? The Spanish, the Portuguese, the Mexican, and the North American dollar; the French franc, the German and Swiss, (since the confederation,) and the Italian coins, all contain  $\frac{1}{10}$  alloy, and were it advisable to deviate from the English standard at all, it might be better to adopt that simple and almost universal system: but now that England has determined to supply her colonies with her own currency in silver coin, it may be perhaps better that the rupee of her Indian possessions should conform thereto as nearly as possible,—and if so, the present opportunity of equalizing the standard should not be allowed to pass by. There is another argument in favor of the measure, namely, that the proposed improvement in quality is nearly balanced by the proposed reduction in weight of our up-country rupee from  $180.23\frac{1}{4}$  to  $180.0$  grains, so that there would be no appreciable difference in commercial or revenue transactions.

It may be urged against the alterations suggested, that they will render useless the splendid standard weights sent out to the several mints of India, by the Honorable Court of Directors, for the express purpose of adjusting the weights of the country: but such is not the case, for these magnificent standards comprize complete sets of troy weights, avoirdupois weights, and bazar weights, and it is the first of these only which can be regarded as the true standard of comparison whereby the other two are to be verified. The Bazar weights may by means of the troy standards be made to conform to the proposed system with the greater facility, because there will be no fractional discrepancies.

We read some time since in the *Government Gazette*, a notice of the verification of the standards alluded to, which was made by order of the Court upon their arrival in India; it gives a high idea of their great exactitude, and of the superior excellence of the superb balances by which these results were obtained: they were sent out by the Honorable Court in the year 1829, and are deposited in the new mint. Assuming the 1 lb. troy as unit, the errors of the following weights were respectively:

On the single troy grain, . . . . . — 0.0019 grain.  
 the sixty pound troy, . . . . — 1.90  
 the one pound avoirdupois, — 0.04  
 the fifty-six pound ditto. . . + 0.71  
 the sicea weight, . . . . . + 0.003  
 the maund, . . . . . + 0.2

A brief description of the principles of the construction of these balances, and of the improvements introduced by Mr. Bate, was given in the *GLEANINGS*, vol. iii. p. 220.\*

Since the examination above alluded to, the standard measures of capacity have also been verified, and have been found equally creditable to Mr. Bate, their maker. They are brass cylindrical vessels, covered with flat glass discs pierced through the centre with a small aperture, so that the quantity of distilled water contained in them may be ascertained with perfect accuracy: ivory handles are attached to them, to prevent an undue influence on the temperature of the metal from the contact of the hand. With due allowance for the temperature of the water used in the experiments, the trifling errors of capacity, expressed in weight of water, were as follows:

| Names of measure. | Weight avoirdupois | Temperature. | Calculated excess in grs. | Observed excess in grs. | Error of capacity in grs. of water. |
|-------------------|--------------------|--------------|---------------------------|-------------------------|-------------------------------------|
|                   | lb. oz.            |              |                           |                         |                                     |
| Gallon, ..        | 10 0               | 77.4         | 95.97                     | 93.4                    | + 2.57                              |
| Half gallon       | 5 0                | 77.3         | 47.59                     | 47.8                    | — 0.21                              |
| Quart, ....       | 2 8                | 77.3         | 23.78                     | 26.3                    | — 2.52                              |
| Pint, ....        | 1 4                | 77.2         | 11.80                     | 8.0                     | + 3.80                              |
| Half pint,        | 0 10               | 77.0         | 5.80                      | 6.2                     | — 0.40                              |
| Qr. pint, ..      | 0 5                | 76.9         | 2.87                      | 2.7                     | + 0.17                              |

The only material error is in the pint measure, where it is equal to 0.015 cub. inch or about three drops; in all the others but the quart the difference is much within what would be caused by a single degree of temperature higher or lower, and consequently within the limits of experimental error. We hope soon to see the liberal intentions of the home government in supplying these splendid instruments of comparison, followed up by a gradual review and reform of the existing multifarious system of weights and measures in their Indian possessions.

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\* It is recorded in the *Ayecn Akbery*, that the great Akher caused the royal standard weights of his empire to be made of polished agate, from the barley-corn up to the 140 *tank* weight (about 1 lb. troy). His example is worthy of imitation everywhere, but more especially in a country where metals are so liable to injury from damp, and acrid perspiration. The new standard weights, although doubly gilded, already exhibit incipient specks of oxidation.

### III.—Remarks on a late Paper in the Asiatic Journal on the Gypsum of the Himalaya. By the Rev. R. Everest.

In the July No. of the Asiatic Journal, there is some information given us on the gypsum of the Himalaya, for which the thanks of all lovers of geology are due to the writer (Capt. Cautley). But as it is accompanied by a theory of the formation of gypsum in general, which seems to have been hastily adopted, and which a more mature consideration of the subject would probably induce him to reject, I shall make no apology for pointing out what I believe to be his error, lest others should be misled by his authority.

Having stated a doubt among geologists respecting the gypsum of the Alps, viz. whether it is primitive or transition, he proceeds to describe the gypsum of the Himalaya, and having done so, thus expresses his opinion as to its origin.

“A question of considerable interest arises from the appearance and position of the above-mentioned deposits, which, as mentioned in a former part of this paper from their position under rocks of the primary and secondary classes acquire an *appearance of antiquity*, not borne out by the general history of the mineral; viz. that the gypsum throughout the globe is simply an *infiltration* analogous to the tufa, and calcareous deposits; and depending on causes chemically similar; the sulphuric acid being the active generator instead of the carbonic. *If in the proximity of sulphur an excess of oxygen would produce sulphuric acid, a difficulty is removed, and the contact with lime-rock, or carbonate of lime would, it may be supposed, produce its sulphate or gypsum; and I cannot perceive the improbability of such a process having been, or being still in force; or that nature's laboratory might not have been as active in the dissemination of gypsum, as it is in the present day, of the calcareous tufa.*”—vide p. 293. And again, p. 295. “If therefore, where carbonate of lime, sulphur, and water are abundant, the chemical change above mentioned is allowed, or is supposed from analogy, to be a probable consequence, gypsum can no longer be entitled to a place in either primary, transition, or secondary classes; but must be considered as an adventitious formation common to all ages, and produced by causes analogous to the present rapid formation of calcareous tufa. Among our primary and transition rocks, none can be assimilated to the stalactitic carbonate of lime; among our secondary or latest class of general rocks, there is none like the gypsum, that is to say, *we know of none actually forming at this day.* Causes that led to the formations of such abundance of gypsum formerly may, from unassignable reasons, no longer exist; and those which produce the tufaceous carbonates, then at rest, may now be in full vigor.”

Did the writer, when he thus proposes as original the opinion of the formation of sulphuric acid from the proximity of sulphur and water, forget that it is the common solution of one of the most common phenomena in geology, I had almost said, in nature; and never

doubted? In almost every bed of clay, where sulphuret of iron and calcareous matter are present, and the bed is so loose as to allow of infiltration, the sulphuret is decomposing and the sulphate of lime forming? Did he not know that the same solution was commonly given and received for the presence of the abundant sulphuric and sulphurous acids, which both rise in vapours from the craters of volcanos and impregnate the mineral waters near them; viz. that they were produced by the decomposition of sulphur and sulphuretted hydrogen. Has he never heard, for instance, of the phenomena of the "Solfatara" near Vesuvius, and the manner in which they are accounted for? Lastly, when he asserted that "we know of no gypsum actually forming at this day," had he forgotten that gypsum, as well as the tufaceous carbonate, is actually forming at present? In proof of this, I will refer him no further than to a popular treatise of the day, Lyell's *Geology*, (vol. I.) Under the head gypsum springs, he may see a notice of that at Baden near Vienna; and a little farther back he will find an account of the baths of San Filippo, where three copious springs deposit calcareous carbonate, with gypsum and sulphate of magnesia.

Having accounted for the formation of gypsum, and thus rendered it probable that some gypsum beds are deposited by infiltration, i. e. by the insinuation of the mineral in solution into cracks and fissures, he comes to the general conclusion that all gypsum is produced by infiltration. That gypsum is analogous to calcareous deposits, is certainly true, but if he had recollected the manner in which calcareous deposits took place, he would have seen that great part of them could not be said to be caused by infiltration. Thus, when a spring containing carbonate of lime in solution issues to the surface, most of its mineral is carried to a neighbouring river; by the river to a lake, or to the sea. We have instances of calcareous beds now forming at the bottom of lakes, and, though we can have no direct evidence of what is going on at the bottom of the sea, we have good reason to believe, that the same process is taking place there. Now the same reasoning holds with respect to sulphate of lime. It is carried down to lakes and seas, and must be precipitated, owing to the evaporation which is continually taking place. If we examine the deposits of carbonate of lime and gypsum, which together constitute great part of our later strata, we find that they tally with the above supposition; viz. that they are precisely such as would have been deposited at the bottom of the lakes or shallow seas. The different remains found in them, the shells, the aquatic vegetables, the amphibious reptiles, the fishes, the mammalia, all point to the same result. Take, for instance, the

Paris basin, as it is called. Here we have gypsum interstratified with beds of sand, marl, and carbonate of lime; now what reason have we to suppose that the gypsum was deposited by infiltration any more than the carbonate of lime, or indeed than the sand and marl; for they too may be held in suspension by springs, as the others may be held in solution. Do not the remains found in each prove that they are all of the same era? The writer talks of the absence of vegetable remains in gypsum. Did he never hear of any in the gypsum near Paris? Moreover, if we *must* suppose the process of infiltration to have taken place for the gypsum, and for that alone, we must also suppose that the place it now occupies was once a hollow. That is, in the country round Paris a subterraneous cavity existed, a few feet in depth, but occupying an area of many miles in extent, covered by a roof composed of loose beds of sand and gravel. The writer may have seen, in examining mines, the great difficulty of driving a tunnel through soft strata, wide enough even for a man to creep through, and the artificial supports it must receive. What could have supported the cavity, we just now supposed, before the infiltration was completed? I forbear from extending these arguments to the gypsum of the earlier secondary formations, but they are equally applicable to them. The writer states that all geologists are agreed as to many beds of gypsum being secondary. One would have thought that circumstance might have made him hesitate before propounding his theory, and conclude, they had some good reasons for doing so. As I have never examined the gypsum of the Alps, I cannot enter into that part of the question; there are one or two other points, however, which I cannot pass over, as they seem like a revival of the obsolete doctrines of Werner. The writer esteems it almost matter of certainty, that the origin of all gypsums is contemporaneous, from the "exact resemblance both in texture and crystallization that they all bear, whether Alpine, or those varieties found with the secondary rocks: a similarity that does not exist in any of the limestones formed at different periods." To refer him no further than the same chapter of the same book, I have already quoted (Lyell), we find there that a rock is now depositing in Italy from a spring, "which cannot be distinguished, in hand specimens, either in grain, colour, or composition from statuary marble." I have myself seen on the continent of Europe a secondary limestone, not distinguishable in texture and crystallization from the primitive marbles which are usually found in beds in mica-slate. Many other instances might be cited to the same effect. Nor is the writer more fortunate in two other assertions he has made, viz. that "quartz veins are the type of tran-

sition," and that primary rocks "are never found reposing on the newer formations."

That identity of mineral structure proves formations to be contemporaneous, and that the order of superposition is invariable, were doctrines laid down by Werner, and for a long time received as axioms in geology. But of late years, a further insight into the phenomena of existing volcanos, and a more extended research over the surface of the globe, have brought both these propositions into doubt, and tended to confirm a belief that natural causes at present in operation are adequate to produce all the appearances that are presented to us. I cannot quote an example of quartz veins in secondary rocks from memory, and at this distance in the country having few books to refer to, I must be content with Jamieson's *Mineralogy*. It is there stated, under the head quartz, that quartz veins are found in secondary rocks as well as in transition. But I could name a locality, in the north of Europe, of granite overlying a transition limestone, and I can refer to Humboldt, as quoted by Daubeny, (on volcanos, p. 350,) for the following as an ascending series: No. 1, granite; 2, Alpine limestone; 3, granite. To the same chapter of the same work I would refer for a description of the porphyry of South America, not distinguishable from the transition porphyry of Europe, which as well as sienite, gradually approximates to trachyte, and passes into it; so that Humboldt considers there is no natural line of separation between the transition and modern volcanic formations of America. What then becomes of the doctrine of contemporaneous origin? It may be matter of convenience to preserve the classification of primary, transition, secondary, and tertiary rocks, for want of a better or as indicative of certain organic remains. But it is prejudicial to the cause of truth to ascribe to the opinion more importance than it deserves; especially in a country as yet almost unstudied, where the disciples of it *must* go forth predetermined to find analogies to the European formations, and to overlook discrepancies.

It may appear presumptuous in me to hazard an opinion respecting a rock which I have never seen, but one or two circumstances mentioned by the writer lead me to believe, that the gypsum beds described by him in the Himalaya are not posterior to the formations with which they are connected. The first of these is, that they are interstratified with a reddish argillaceous schist. Now although it may be conceived to be possible that liquid sulphate of lime might have been forcibly thrust between two layers of rock of a different nature, as we see is frequently the case with lava, trap, and granite; there is nothing in the history of gypsum which leads us to believe it would happen. It

is but rarely found in veins, and never is, I believe, the sole substance that fills a vein. My second reason is, that he describes it as passing into the limestone with which it is connected. Now, it is usually inferred, that rocks in juxta-position, which approximate and gradually pass into each other, are contemporaneous, or at least next in succession to each other. The passage of one into the other at least proves, that the one, if not semi-fluid, was loose, earthy, and unconsolidated, so as to admit of being penetrated by the other, at the time of their junction.

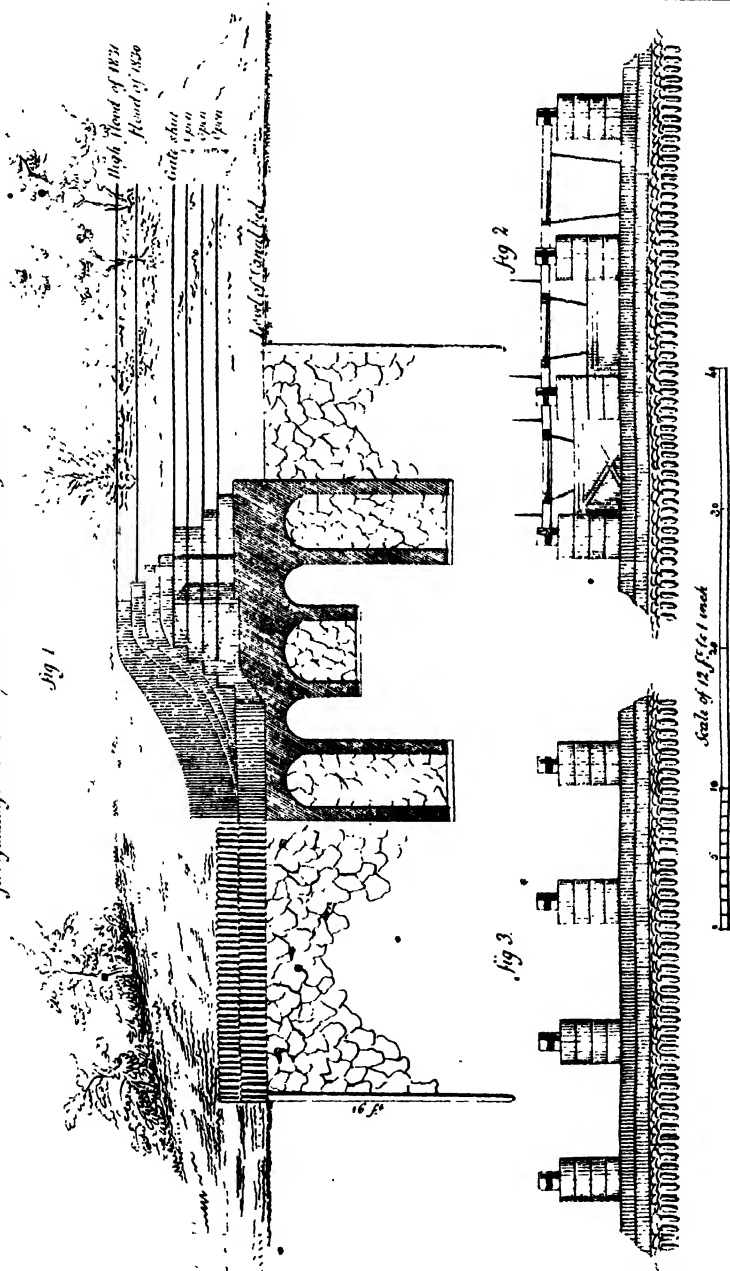
#### IV.—*Description of the Regulating Dam-Sluices of the Doab Canal.*

To provide a clear and open water-way during floods, unimpeded by the superstructure, which is generally attendant on sluice gates, and to facilitate their removal on sudden freshes, the following construction has been adopted at the dams over the large mountain torrents that cross the Doab canal in the country north of Sahárunpúr. Although merely a modification of the old self-regulating gate, it may be perhaps worth noticing, as I am not aware that an arrangement similar in detail has either been put in practice before in works of this nature, or that gates depending on lower pivots for their movements, have ever been alluded to in any books treating of canal works.

It may be necessary to mention, that the mountain torrents which cross the lines of the Doab canal, in their northern extremities, only flow during the rainy months, when continued falls of rain in the lower mountain range, and on the belt of forest that skirts them to the south, give rise to very sudden and rapid drainage, which being effected on the line of these rivers, or as they are provincially termed *rows*, cross the canal at right angles, and pass off by a series of sluice openings, fixed in masonry dams across their channels. On these occasions the volume of water is not more to be guarded against than the quantity of floating logs, large forest trees, roots, grass, &c. that the water collects in its course, for all of which a passage is as absolutely necessary as for the water itself. As the canal supply of water depends entirely on these masonry dams, and the facility of regulating the sluices in them, so that they may remain closed and be opened upon the occurrence of sudden freshes, is of absolute necessity, the main point, to be attended to, is to provide openings sufficiently large for the escape of the greatest quantity of water that the channel will carry, yet of such a size that the opening and shutting of the whole line can be effected in the shortest possible



SALUTCH GATES  
for regulating flood waters upon the Muskouri & Nigoun Rivers



Inventor, J. H. Fawcett, Esq.



time, and with the least possible labor; at the same time avoiding the application of superstructure in the shape of a fixed road-way and lifting gates; in short, to throw the whole dam as open as possible, and to relieve it from any obstructions that may interfere with the free passage of the floating timber, &c. It will appear evident, that, the best sort of dam in a position of this nature would be a simple flooring of masonry, with flanks of the same material; the bund or bank for retaining the water being constructed of earth, gabions, &c. which although it would be annually washed away during the rains, would be repaired at a trifling expense, and the space of masonry between the flanks would provide an escape sufficiently ample, and at the same time perfectly free and unimpeded by any interruptions from piers, &c. in its width. This species of dam would best suit a situation, where the heavy freshes only rise once during the year, and springs of sufficient abundance occur below the works to keep the southern line of canal supplied with water; but in the present case, the destruction of these bunds or dams, and the loss of the head supply from the mountain streams, would leave the canal nearly dry, as there are but a few scanty springs in the southern limits. To meet this difficulty the following form of sluice has been introduced in the dams over the Rogaon and the Muskára rivers, on the Doab canal works; and as the experience of two rainy seasons has proved its efficacy, and shewn a facility of working, which was in a measure unexpected, I cannot do better than enter into a short description, accompanying it by a sketch, which will also exhibit the high-water mark of the floods that have occurred within the last two seasons.

Fig. 1—Represents a tranverse section through the centre opening of the Muskára dam. The gate being closed, the flank revetment is shewn at the back. The horizontal lines explain the different levels at which the canal supply may be regulated. The two upper lines shew the high-water marks of floods in the rains of 1830 and 1831. The former of 8 feet 9 inches, and the latter of 10 feet, from the flooring of the dam.

Fig. 2—Shews an elevation of three openings of the dam, with the sluice gates at different angles, the windlasses and chains fixed, &c.

Fig. 3—Shews three similar openings, with the gates dropped, and the windlasses, chains, &c. removed, as happens in the height of the rains, when the rivers are subjected to continual floods. The gates moreover act as self-regulators on certain occasions, especially on the approach of the flood water from the hills, which is generally sudden, although its approach is perfectly well known to the inhabitants of this part of the country.

The gates are made to fit the grooves in the masonry as closely as possible, so as not to fall by their own weight, but to depend on the increased pressure of the rise of water for their removal in these sudden floods: the arrangement on these occasions is simple, the catches fixed to the bit-heads are removed from the ratchet wheels

at the end of the windlasses, and the handspikes being removed also, a rise of a few inches in the water throws the whole dam open at once—a method that is usually practised in the cold-weather floods, and when the rise of the water is not very great. In the height of the rains, the logs of wood and rubbish borne in the waters makes this out of the question; fig. 3 being the state of the sluices at that period.

August 18, 1832, *Northern Doub.*

B. r

V.—*Note on the Jabalpúr Fossil Bones.* By James Prinsep, Sec., &c.

[Read at the Meeting of the Physical Class, 3rd October.]

In consequence of a hint from Dr. Hugh Falconer, that he had heard of the discovery of some fossil bones at Jabalpúr, I inserted a notice in the June number of the Journal, soliciting information on the subject from some of my correspondents on the Nerbadá.

I am happy to say, that my appeal has not been ineffectual, and that the subject has been taken up with zeal by Doctor G. G. Spilsbury, Civil Surgeon at Jabalpúr. That gentleman has sent me by dák three specimens of the fossil bones for presentation to the Society, promising a further supply when the season shall enable him to visit the spot, and offering to conduct any extended investigations which the Physical Class may point out as desirable to elucidate the subject. Doctor Spilsbury informs me, that the fossil remains were discovered by Captain Sleeman two years ago. They are not mentioned by Capt. Franklin in his survey of that part of the country, printed in the 1st pt. *Trans. Phys. Cl.* neither by Dr. Voysey, nor Captain Coulthard: Captain Sleeman is therefore entitled to the sole credit of having brought the interesting fact to light, and we may hope from his official situation that he will zealously take measures for making a particular examination of the spot, so as to extract if possible some fragments of bone in better preservation, and enable us to ascertain to what animals they belong, and to what epoch of the world's history they may be referred.

Dr. Spilsbury describes the locality as being about  $1\frac{1}{2}$  miles N. E. of the residency at Jabalpúr, on the northern side of a broken range of limestone hills, capped with a horizontal layer of trap, rising from the valley of the Nerbadá, about 150 feet to the east of the small rising ground, where the petrified tree was discovered, which is in the museum.

The three specimens sent are in too mutilated a condition to enable us to pronounce what they may be, but the osseous structure of the two first is very apparent.

They differ materially from the fragments of Himalayan fossil bone brought down by Mr. Royle in January, inasmuch as the latter contain-

ed its natural quantity of animal matter unaltered, whereas all of these now before us are thoroughly mineralized,—that is, the whole of the animal substance has in them been replaced by earthy matter, which proves to be of different quality in each; the following are the results of a hasty chemical examination of them.

No. 1.—In this specimen, the osseous part has become quite friable and white, as if it had been burnt, while the membranous fibre has been replaced by crystals of carbonate of lime of a delicate greenish hue: I separated a small portion of these crystals with care, and analysed them by solution in muriatic acid, in a glass measure over mercury: the carbonic acid disengaged was equivalent to 82.5 per cent. of carbonate of lime; the remainder was phosphate, which had adhered to the crystals. The white part treated in a similar way gave,

|   |             |
|---|-------------|
| Carbonate of lime, .....  | 11.0        |
| Phosphate of lime dissolved with ditto and precipitated by ammonia, ..  | 85.5        |
| Needle-form silicious fibres evidently deposited by infiltration, ..... | 0.5         |
|   | <hr/> 100.0 |

There was no trace of animal matter.

No. 2.—The appearance of this bone is more compact than the first: the membranous texture has in some places taken a fine puce color, and in others a green tinge: treated as before, or rather calculating the carbonate from the *weight* of gas expelled; and the phosphate from the amount dissolved by the acid, in excess of the carbonate, its composition was,

|  |             |
|--|-------------|
| Carbonate of lime, .....   | 16.0        |
| Phosphate of lime, .....   | 71.0        |
| Skeleton of siliceous more complete than the first; color jasper red, .. | 13.0        |
|  | <hr/> 100.0 |

No. 3.—This specimen has become almost entirely silicified; it scratches glass; does not effervesce with acids, and only yields one per cent. to boiling nitric acid: it is unaltered before the blow-pipe.

Before Mr. Royle went home, he gave me a fragment of porous calcareous stone, found by him somewhere on the banks of the Jamna, which he imagined to be fossil bone: I did not then minutely examine it, but I am now happy to confirm his opinion, and only regret, that I have not the locality to pursue the inquiry further: the animal matter of this specimen, No. 4, is gone, and is replaced only by loose dirt: the composition of the osseous part is,

|                               |             |
|-------------------------------|-------------|
| Carbonate of lime, .....      | 18.0        |
| Phosphate of lime, .....      | 80.0        |
| Brown ochreous residue, ..... | 2.0         |
|                               | <hr/> 100.0 |

The ammon. precipitate of phosphate was digested in sulphuric acid, and converted into sulphate : the filtered solution was then proved to contain phosphoric acid by its behaviour with muriate of magnesia and ammonia. The analysis was not carried farther than to the demonstration of the presence of the phosphates generally, and their amount in round numbers.

The Ava fossil bones were found to be mineralized also, and to have lost their animal matter, but they differ again from either the Himalayan or the Jabalpúr fossils in regard to the mineralizing substance, and are of two distinct kinds.

4. The first, a dark brown heavy substance, is impregnated with iron clay, yielding on analysis,

|  |     |        |
|--|-----|--------|
| Carbonate of lime, .....                           | 25. | } 100. |
| Phosphate of lime dissolved in nitric acid, ....   | 31  |        |
| Silex and oxide of iron, &c --not dissolved, . . . | 11. |        |

5. The second or earthy bone from Ava proved to be wholly converted into carbonate of lime, colored merely with a little clay-iron of a dirty greyish brown.

**VI.—*List of Articles of Materia Medica, obtained in the Bazar of the Western and Northern Provinces of India.* By J. F. Royle, Esq. late Superintendent of the Botanic Garden, Sahárunpúr.**

The following table was by no means drawn up with a view to publication ; thinking it however eminently fitted to assist naturalists in India in pursuing their investigations of the natural products of the country, we obtained the author's permission to make use of it as it is. In the 11th volume of the Asiatic Researches will be found a catalogue of a similar nature, drawn up by Dr. Fleming and Professor Carey, of such articles of Materia Medica, drugs, minerals, and plants as were procurable in the bazars of Bengal, with notes of the uses and qualities of many of them. The present table contains very numerous articles foreign to that list, and to these provinces altogether ; and besides the advantage of the progress of botanical knowledge since that time, the plants of many of the drugs not cognizable by their external appearance have been procured and cultivated by Dr. Royle in the Sahárunpúr Garden, to ascertain their real nature, and to compare them with the description given in the works of Aristotle, Dioscorides, Pliny, Avicenna, and the ancient Arabic authors. These remarks relate more particularly to the voluminous catalogue of plants, &c. taken home by Dr. Royle, which we hope ere this has been put into the publisher's hands ; but the present epitome of such substances

as were procurable in the open bazars is entitled to the greater confidence, from having been corrected by those more ample tables. Where uncertainty prevails about any article, it has been left in blank to be filled up hereafter with a pen; and we shall take care to advise our readers when we obtain any information for the completion of the list. Meantime, we can but recommend to others to make similar catalogues in Central, Southern, and Eastern India, so as to form an appendix to the one before us.

The alphabetical order followed by Dr. Royle is, it will be seen, that of the Arabic language, because the names in the first column are mostly those which occur in the Arabic medical works. This can be attended with inconvenience only to the very few in India who may be ignorant of the Persian alphabet: whereas, on the other hand, it affords facility in recognizing the native names, and in referring to native works: besides which, those who are acquainted with the oriental name (and such acquaintance is implied in a catalogue giving English synonyms) can more readily seek for it under the Persian initial than under the English, which may vary *ad libitum* according to the system, fancy, or ignorance of the writer.

The numbers in the first column refer to the specimens in Doctor Royle's cabinet: the second column contains the Arabic names: the third gives synonymes, generally Hindústani: the fourth shews the part of the plant sold or used as a drug: then follow the Botanical name and the place whence procured, the latter depends frequently upon the declaration of the venders, and is consequently vague, as in the case of "India," where the particular place cannot be defined. In some instances a locality is given as being *mushhár*, or noted for supplying a good quality of what may otherwise be common to many other parts of the country;—where "gardens" are mentioned, either the Selárunpúr, or the Calcutta Botanic Garden is intended.

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| etc.<br>uer. | Name under<br>which Article<br>is described in<br>Catalogue. <i>a/</i> | Hindustani or other<br>synonyme. | Part used. | Botanical name.          | Whence<br>obtained. |
|--------------|--|----------------------------------|------------|--------------------------|---------------------|
| 1            | Aarghis,   | Zirishik, <i>p.</i>              | bark,      | Berberis <i>chitra</i> , | Hills.              |
| 2            | Abrún, (house leek.)   |                                  | plant,     | Labiata, n. o.           | Delhi.              |
| 3            | Abúkhalsá,   | Ratanjot,                        | root,      | Buglossum?               | Multan.             |
| 4            | Abukanis, (sow bread.)   |                                  | do.        | Cyclamen,                | Turkey.             |
| 5            | Abhul,   | Húbér,                           | fruit,     | Juniperus,               | Auritsér.           |
| 6            | Útaruj,  | Bijaora nimbu,                   | peel,      | Citrus,                  | Gardens.            |
| 7            | Atis,  | Butis,                           | root,      | Aconitum <i>atees</i> ,  | Hills.              |
| 8            | Asal,  | Pharus,                          | seed,      | Tamarix,                 | India.              |
| 9            | Aslak,   | Sambhálú,                        | fruit,     | Vitex trifolia,          | Do.                 |

*a/* Indian names in the first column are printed in italics, to distinguish them from the rest, which are Arabic.

| Reference. | Name under which Article is described in Catalogue. | Hindustani or other synonyme. | Part used.      | Botanical name.                            | Whence obtained.  |
|------------|---|-------------------------------|-----------------|--|-------------------|
| 10         | Ijás,   | Alū Bokhara,                  | fruit,          | <i>Prunus Bokhariensis</i> ,               | Kabul.            |
| 11         | Ujmaūd ?  | Ajwain,                       | seed,           | <i>Ligusticum ajwain</i> et diffusum,      | India.            |
| 12         | Abriz,  | Kasumphūl,                    | do.             | <i>Umbellifera</i> ,                       | Khadir.           |
| 13         | Akhirus,  | Kal-gihūn,                    | do.             | <i>Carthamus tinctorius</i> ,              | India.            |
| 14         | Adā, adiak,   | (Green ginger),               | root,           | <i>Coix Indica</i> ,                       | Hills and Khadir. |
| 15         | Azāraki,  | Kouchla,                      | seed,           | <i>Zingiber officinalis</i> ,              | Ind. Hills,       |
| 16         | Izkhir,   | Mirchagauvl,(hél),            | root,           | <i>Strychnos, nux vomica</i> ,             | India.            |
| 17         | Anjār,  | Badām kōhi,                   | seed,           | <i>Andropogon</i> ,                        | Do.               |
| 18         | Arīu,   | Tah-buranga,                  | root,           | <i>Prunus chūlū</i> ,                      | Hills.            |
| 19         | A'as,   | Mendi ?                       | fruit,          | <i>Bignonia Indica</i> ,                   | India.            |
| 20         | Asarūn,   | Taggar,                       |                 | <i>Myrtus communis</i> ,                   | Kashmir.          |
| 21         | Ustukhudūs,   | Dharu,                        | plant,          | substitute for <i>Asarum Eur.</i>          | Hills.            |
|            |   |                               |                 | <i>Prunella</i> (substitute for <i>La-</i> |                   |
|            |   |                               |                 | <i>vandula strichos</i> ),                 | Kabul.            |
| 22         | Asgandeh,   | Nagnori,                      | root,           | <i>Physalis flexuosa</i> ,                 | India.            |
| 23         | Isqil, unsul,                                       | Kandri,                       | root,           | <i>Scilla Indica</i> , (squill),           | Do.               |
| 24         | Usturkhār,  | Uut katāra,                   | plant,          | { <i>Fagonia Mysorensis</i> ?              | Delhi.            |
|            |   |                               |                 | { <i>Echinops spherocephalus</i> ,         | Firth.            |
| 25         | Ushneh,   | Chalehalira,                  | do.             | { <i>Lichen Islandicus</i> ,               | Hills.            |
|            |   |                               |                 | { <i>L. from hills</i> substituted,        |                   |
| 26         | Aftimūn,  | Akās bel,                     | do.             | <i>Cuscuta Europæa</i> (reflexa, subs.)    | Kabul.            |
| 27         | Afrankeh,   | Aflunkeh,                     | seed,           | <i>Urtica</i> ,                            | Do. and Delhi     |
| 28         | Afsantin,   | Satāra,                       | do.             | <i>Artemisia absinthium</i> ,              | Kabul.            |
|            |   |                               | plant,          | ———— <i>Indica</i> ,                       | Amritsér.         |
| 29         | Aftimūn,  |                               | root,           |  | Delhi or Surat.   |
| 30         | Atus,   | Afus g.                       | plant,          |  | Do.               |
| 31         | Akakia,   |                               | ext. fr.        | <i>Acacia vera</i> ,                       | Arabia via Delhi. |
| 32         | Akas bel,   |                               | plant,          | <i>Cuscuta reflexa</i> ,                   | India.            |
| 33         | Akit makit,   | Kal-karenja,                  | seed,           | <i>Cæsalpinia Bonducella</i> ,             | Do.               |
| 34         | Akrora,   |                               | root,           | <i>Cyperaceæ</i> ?                         | Delhi.            |
| 35         | Akr-ul-bahr,  |                               | wd. and bk.     |  | Pérab.            |
| 36         | Ikhl-ul-jubal, flower-buds of one of the            |                               |                 | <i>Myrtaceæ</i> (subst. for rosemary)      | Surat.            |
| 37         | Ikhl-ul-malek, parang,                              |                               | fruit,          | (leguminosæ),                              | Kabul.            |
| 38         | Alu sarāsūn, (alu sun ?)                            |                               | plant,          |  | Surat.            |
| 39         | Amáritun,   |                               | do.             |  | Do.               |
| 40         | Amdaryan,   | Amdarban,                     | berry,          |  | Arabia.           |
| 41         | Amār bel,   |                               | do.             |  | Amritsér.         |
| 42         | Amras,  |                               |                 | concretion found in old mango-wood,        | Delhi.            |
| 43         | Amśūkh,   |                               | seed and berry, |  | Surat.            |
| 44         | Um-ghilan,  | Kekar,                        | fruit,          | <i>Mimosa Arabica</i> ,                    | Indic.            |
| 45         | Amal béd,   |                               | Acid twigs,     |  | Delhi.            |
| 46         | Amraj,  | Aonla,                        | fruit,          | { <i>Phyllanthus emblica</i> ,             | Hills.            |
|            |   |                               |                 | { <i>Emblia myrobalaus</i> ,               |                   |
| 47         | Ambaj,  | Am,                           | do.             | <i>Mangifera indica</i> ,                  | Do.               |
| 48         | Amebūr,   | unripe,                       | do.             | Dried do.                                  |                   |
| 49         | Anteleh,  | Nirbisi,                      | root.           | <i>Caltha nirbisi</i> ,                    | Amritsér.         |
| 50         | Anjibár Rumī,                                       | Bistort,                      | do.             |  | Kabul.            |
| 51         | Anjudān,  |                               | seed.           | <i>Ferula asafoetida</i> ,                 | Arabia.           |



| Refe-<br>rence. | Name under<br>which Article<br>is described in<br>Catalogue. | Resident or other<br>synonym. | Part used.      | Botanical name.                       | Whence<br>obtained.    |
|-----------------|--|-------------------------------|-----------------|---------------------------------------|------------------------|
| 52              | Anjudán 2nd,   |                               | seed,           |                                       | Surat.                 |
| 53              | Anjureh,   | Utangan,                      | seed,           | Urtica,                               | Kabul.                 |
| 54              | ———— 2nd,  | Nettle seed,                  | seed,           | Urtica,                               | Marwar.                |
| • 55            | <i>Andhauli</i> ,  |                               | wood,           |                                       | Dehli.                 |
| 56              | Anésun,  |                               | seed,           | { applied to<br>{ Apron petro selima, | { Room.<br>{ Kabul.    |
| 57              | Awáfinús,  |                               | seed and plant, |                                       | Surat.                 |
| 58              | <i>Anja</i> ,  | Chirchira,                    | seed,           | Achyranthes argentea,                 | India.                 |
| 59              | Ahlilaj.   | Bywareh,                      | fruit,          | Terminalia Chebula,                   | Do.                    |
| 60              | — asfar,   | Har-zard,                     | fruit,          | Ditto,                                | Do.                    |
| 61              | — aswad,   | Ditto senh,                   | fruit,          | Ditto,                                | Do.                    |
| 62              | — — aswad jua, jawi haré,                                    |                               | fruit,          | Ditto,                                | Do.                    |
| 63              | Umaranútáh,  |                               | berry,          |                                       | Surat via Dehli.       |
| 64              | <i>Babchi</i> ,  |                               | seed,           |                                       | Purab.                 |
| 65              | Babúna, p.   | Chamomile,                    | flower,         | Anthemis nobilis,                     | India.                 |
| 66              | Bad-áward,   |                               | berry,          | Hedysarum Albugi ?                    | Surat.                 |
| 67              | Badranjboyeh,  | Billé-lotan,                  | plant,          | Ocimum "                              | Purab.                 |
| 68              | Badrij,  | Jangla túlsi,                 | seed,           | Ocimum,                               | Furakhabad.            |
| 69              | Badmjan,   | Bagan, Egg plant,             | do.             | Solanum melangena,                    | India.                 |
| 70              | Badyankhatái,  | Star-anise,                   | do.             | Illicium anisatum,                    | China.                 |
| 71              | Billa-t-kand,  |                               | root,           |                                       | Kabul.                 |
| 72              | Bardast,   | Abnús, ebony,                 | wood,           | Diospyros,                            | India.                 |
| 73              | Biqila,  | Sen-chama, bean,              | seed,           | Faba vulgaris,                        | Do.                    |
| 74              | Baqila-wisi,   |                               | do.             | Nelumbium speciosum,                  | Do.                    |
| 75              | <i>Balangá</i> , túkhu,                                      |                               | do.             | { Draconophalum<br>{ Royleum,         | { Kanour.<br>{ Rewari. |
| 76              | <i>Bansa</i> ,   |                               | leaf,           | Justicia adhatida,                    | India.                 |
| 77              | <i>Bipsar</i> ,  |                               | wood,           |                                       | Dakhan.                |
| 78              | <i>Bdavi kand</i> , Surát chip,                              |                               | root,           | Hedysarum tuberosum,                  | Purab.                 |
| 79              | <i>Bidhára</i> .   |                               | do.             |                                       | Gaugake Khadir.        |
| 80              | <i>Barkak</i> ,  |                               | berry,          | A scaulent plant,                     | Surat.                 |
| 81              | Barq-Tibet,  | Hulas Kashmiri,               | root,           | Rhododendron campanulatum,            | Kashmir.               |
| 82              | Barn dandi,  |                               | plant,          | Centurea,                             | India.                 |
| 83              | Birin jást,  |                               | berry,          | Artemisia,                            | Najibabad.             |
| 84              | Biranj kabuli,   | Bae hirang,                   | seed,           | Embelia ribes,                        | Do.                    |
| 85              | Baryaleh,  | Kharánti,                     | berry,          | Sida cordifolia,                      | India.                 |
| 86              | Bazr katuna,   | Asafghúl,                     | seed,           | Plantago isafghola,                   | Gadens.                |
| 87              | Buz ghunj,   |                               | galls,          | Pistacia vera,                        | Kabul.                 |
| 88              | Basbáseh,  | Gawantri, mai,                | galls,          | Myristica moschata,                   | Purab.                 |
| 89              | Bastiaj,   | khilal-i-mekka,               | seed,           | — composita,                          | Dehli.                 |
| 90              | Basfaj,  |                               | root,           | Polypodium vulgare,                   | Kabul.                 |
| 91              | <i>Bis khapra</i> ,  |                               | do.             | Trianthema pentandria,                | India.                 |
| 92              | <i>Bis mar</i> ,   |                               | wood,           |                                       | Dehli.                 |
| 93              | Battikh Hindi,   | Tarbúz,                       | seed,           | Cucurbita citrullus,                  | India.                 |
| 94              | Baklat-ul-hamka,   | Kúlfá, Ionia,                 | do.             | Portulacca oleracea,                  | Do.                    |
| 95              | Baqam,   | Patlung,                      | wood,           | Carsalpinia Sappan,                   | Do.                    |
| 96              | Bakúmbar,  | Kúmbha,                       | flower,         | Carèya arborea,                       | Do.                    |
| 97              | Baládur,   | Bhiláwar,                     | seed,           | Semecarpus anacardium,                | Do.                    |

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|-------|---|-------------------------------|------------|---------------------------------|------------------|
| 98    | Balsáu,   | Balm of Gilead tree,          | wood,      | Balsamodendron Gileadense,      | Surat.           |
| 99    | Bazrui banj,  | Ban ?                         | seed,      | Quercus ban,                    | Do.              |
| 100   | Bale-laj,   | Bahera,                       | fruit,     | Terminalia bellerica,           | India.           |
| 101   | Banj,   | Ajwain khorasani,             | seed,      | Hyosciamus niger,               | Delhi.           |
| 102   | Baudál,   |                               | fruit,     | { Momordica,<br>lep. echinatus, | { India.         |
| 103   | Bundaq,   | Fándak,                       | seed,      | Corylus lacosa,                 | Hills.           |
| 104   | Bundak Hindi,                                       | Ritha, Soap nut,              | fruit,     | Sapindus detergens ?            | Deyra.           |
| 105   | Banafsaj,   | Banafshel,                    | flower,    | Viola serpens,                  | Kashmír.         |
| 106   | Bau Karcia,   |                               | fruit,     | Cucurbitaceæ,                   | Below hills.     |
| 107   | Bozidán,  |                               | root,      |                                 | Surat.           |
| 108   | Boi-mádarán,  |                               | fruit,     | — [composition ?]               | Delhi, Surat.    |
| 109   | Boi,  |                               | do         | Amaranthus tomentosus,          | Delhi.           |
| 110   | Bhà-rangí,  |                               | bark,      |                                 | Almora.          |
| 111   | Bhaiphalí.  |                               | berry,     | (leguminosæ.)                   | Delhi.           |
| 112   | ———— 2nd,   |                               | do,        |                                 | Do.              |
| 113   | Bahman, súkh,                                       |                               | root,      |                                 | Kabúl.           |
| 114   | ———— súféd,   |                               | do,        |                                 | Surat.           |
| 115   | Bij-band,   |                               | seed,      |                                 | Delhi.           |
| 116   | Bél,  | Belgiri,                      | fruit,     | Egle marmelos,                  | India.           |
| 117   | Baengan,  | Jangli kathail,               | do.        | Solanum,                        | Delhi.           |
| 118   | Besh,   |                               | root,      |                                 | Guzerat.         |
| 119   | Bhambel,  | Kasuri n.                     | bark,      | Euonymus tingens,               | Hills.           |
| 120   | Padil,  | Parúl ?                       | fruit,     | Bignonia suaveolens,            | India.           |
| 121   | Pakhán-bed,   |                               | root,      | Saxifraga ligulata,             | Hills.           |
| 122   | Pamri,  |                               | root,      |                                 | Surat.           |
| 123   | Papíñá,   | (St. Ignatius bean,)          | seed,      | Strychnos Ignatia,              | Párab.           |
| 124   | Patol-pattar,                                       |                               | extract,   |                                 | Delhi.           |
| 125   | Pars-i-oshan, nobarika,                             |                               | plant,     | Adiantum,                       | Hills.           |
| 126   | Pusht burni, Chit-kabra,                            |                               | root,      | Hedysarum Alopecuroides,        | India.           |
| 127   | Palás papreh, Dhak-papra,                           |                               | seed,      | Buta frondosa,                  | Do.              |
| 128   | Pañcar,   |                               | do.        | Cassia tora? obtusifolia,       | Do.              |
| 129   | Pilaikanda,   |                               | root,      |                                 | Delhi.           |
| 130   | Phalwa,   |                               |            | Bassia butyracea,               | Almora.          |
| 131   | Pokhar mál, Baghar mul,                             |                               | root,      |                                 | Guzerat.         |
| 132   | Palu, ,   | Keril,                        | fruit,     | Capparis aphylla,               | Hansi.           |
| 133   | Petha,  | Kumra,                        | seed,      | Cucurbita pepo,                 | India.           |
| 134   | Tal-mokhana, Isgandhanagori,                        |                               | do,        | Barleria longifolia,            | Do.              |
| 135   | Tirayaman,  |                               | root,      | Anatis ?                        | Kabúl.           |
| 136   | Turbad,   | Nasli,                        | do.        | Convolvulus Turpethum,          | India.           |
| 137   | Tashmazaj,  | Cháksú,                       | seed,      | Cassia acacalis,                | Deyra.           |
| 138   | Turnus,   |                               | do.        | Lupinus albus,                  | Egypt.           |
| 139   | Tamr,   | Chuleara,                     | fruit,     | Phoenix dactylifera,            | Arabia.          |
| 140   | Taur-Hindi,   | Indi,                         | seed,      | Tamarindus Indica,              | India.           |
| 141   | Tamtirih,   | Tung ?                        | seed,      | Rhus parviflorus,               | India.           |
| 142   | Taroi siah,   |                               | do.        | Luffa,                          | Do.              |
| 143   | — ghin,   |                               | do.        | — acutangula,                   | Do.              |
| 144   | — karwi,  |                               | do.        | — pentandra,                    | Do.              |

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|---------------|--|---------------------------------|------------|-------------------------|---------------------|
| 145           | Túdri suféd,   |                                 | seed,      | Cheiranthus,            | Gardens.            |
| 146           | — surkh,   |                                 | do.        | Malva                   | India.              |
| 147           | — zard,  |                                 | do         | — — — ?                 | Kabúl.              |
| 148           | — gulgún,  |                                 | do.        | — — — ?                 | Surat.              |
| 149           | Tej-bal,   |                                 | wood,      | Xanthoxylum aromaticum, | Hills.              |
| 150           | Tin,   | Anjir,                          | fruit,     | Ficus Carica?           | Kabúl.              |
| 151           | Tent,  | Keril,                          | do.        | Cipparis aphylla,       | Karnal.             |
| 152           | Samrat-ul-asl,   | Chhoti maf,                     | galls,     | of Tamarix dioica,      | India.              |
| 153           | — — — ut-tarfá,  | Buri mai,                       | do.        | — — — — — Indica,       | Do.                 |
| 154           | Jamphal,   | Safri-ám,                       | seed,      | Psidium pyrifera?       | Surat.              |
| 155           | Jáwars,  | Bájra,                          | do.        | Panicum spicatum,       | India.              |
| 156           | Janghás,   |                                 | root,      | — — — polypodium,       | Surat.              |
| 157           | Jadwár,  | Nirbisi,                        | do.        | Caltha, (Kyllinga),     | Amritsér.           |
| 158           | Jujir,   | Tireh tezak, p. Tirmira,        | seed,      | Moricandia tira,        | India.              |
| 159           | — — — 2nd kind,  |                                 | do.        |                         | Surat.              |
| 160           | Jazar,   | Gájar,                          | do.        | Daucus Carota,          | India.              |
| 161           | Júlnár,  | Gul-anar,                       | flower,    | Punica granatum,        | Do.                 |
| 162           | Jal nim,   |                                 | plant,     |                         | Dehli.              |
| 163           | — — — 2nd,   |                                 | do.        |                         | Do.                 |
| 164           | Jintána,   | Pakhán béd,                     | root,      | Gentiana?               | Kabúl.              |
| 165           | — — — 2nd,   |                                 | do.        |                         | Surat.              |
| 166           | Jawansa,   |                                 | plant,     | Hedysarum Allagi,       | India.              |
| 167           | Jouz,  | Akhrot,                         | fruit,     | Juglans regia,          | Hills.              |
| 168           | Jouz-us sarv.  | Sarú, Saras,                    | do.        | Cupressus sempervirens, | India.              |
| 169           | Jouz-ul-katát,   |                                 | do.        | Solanum                 | Arabia.             |
| 170           | Jouz-ul-kai,   | Macnphal,                       | do.        | Posoqueria dumetosa,    | India.              |
| 171           | Jouz-hoa,  | Jai-phal,                       | seed,      | Myristica moschata,     | Púrah.              |
| 172           | — — — 2nd,   | (Nutmeg.)                       | do.        | — — — ?                 | Do.                 |
| 173           | Jouz-rúmi,   |                                 | fruit,     |                         | Surat.              |
| 174           | — — — másil,   | Dhatúra,                        | seed,      | Datura metel,           | India.              |
| 175           | — — — aswad,   | Kala dhatúra,                   | do.        | — — — — — fatuosa,      | Do.                 |
| 176           | Jounchi,   |                                 | plant,     |                         | Dehli.              |
| 177           | — — — 2nd,   |                                 | berry,     |                         | Do.                 |
| 178           | Jia pota,  | Putranjiva,                     | fruit,     | Nageia putranjiva,      | India.              |
| 179           | Chab,  |                                 | berry      | of gaj-pipal,           | Najibabad           |
| 180           | Chándni,   |                                 | seed,      | [an convolvuli?]        | Dehli.              |
| 181           | Chái, cha,   | (Tea.)                          | leaf,      | Thea viridis,           | China.              |
| 182           | Chirya kand,   |                                 | root,      |                         | Kashmir.            |
| 183           | Chalápa,   | (Jalap.)                        | do.        | Convolvulus jalapa,     | Dehli.              |
| 184           | Chilghoza,   | Nuoza,                          | seed,      | Pinus neoza,            | Amritsér.           |
| 185           | Chámpa,  |                                 | do.        | Michelia Champaca,      | Hills.              |
| 186           | Chòb chíni,  |                                 | root,      | Smilax Chinae,          | Púrah.              |
| 187           | Chúk,  |                                 | do.        |                         | Amritsér.           |
| 188           | Chonch,  | Pát,                            | seed,      | Corchorus olitorius,    | India.              |
| 189           | Hásha,   |                                 | plant,     | (given for thyme.)      | Surat.              |
| 190           | Háshish,   | Husn-i-yúsf, p.                 | seed,      |                         | Murwar.             |
| 191           | Hab-ul-bán,  | Bakain,                         | fruit,     | Melia sempervirens,     | Surat.              |
| 192           | Hab-ul-balsán,   | Túkhn balsa,                    | seed,      | Carpobalsamum           | Arabia.             |

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| 193        | Habut-ul-khazrá,                                    | (green seed,)                 | seed,       | <i>Pistacia terebinthus</i> ,      | Kabúl.          |
| 194        | Hab-uz-zulam,                                       |                               | do.         |                                    | Arabia.         |
| 195        | — simneh,   | { Piyal ke bij,<br>Chiramaji, | } do.       | <i>Buchanania latifolia</i> ,      | Najibabad.      |
| 196        | — ghár,   | (laurel berries),             | fruit,      | <i>Laurus nobilis</i> ,            | Arabia.         |
| 197        | — qúlt,   | Kulthí,                       | seed,       | <i>Dolichos</i>                    | Hills.          |
| 198        | — Qilkil,   | Kúlkúl, Karávi,               | do.         | <i>Cardiospermum Halicacabum</i> , | India.          |
| 199        | — nahlab,   | Gyuni,                        | do.         | <i>Rhus</i> ?                      | Almora.         |
| 200        | — ml,   | Kaldona,                      | do.         | <i>Spomaea cœrulea</i> ,           | India.          |
| 201        | Hurf,   | Hálim,                        | do.         | <i>Lepidium sativum</i> ,          | Do.             |
| 202        | Harmal,   | Isband,                       | do.         | <i>Corchorus capsularis</i> ,      | Do.             |
| 203        | *Hasak,   | Gokrá dakhani,                | do.         | <i>Pedalum nurex</i> ,             | Hafra.          |
| 204        | —   | Gokrá,                        | do.         | <i>Tribulus launginosus</i> ,      | India.          |
| 205        | Huzuz hindi,  | Rasot,                        | extract,    | <i>Berberis Asiatca</i> ,          | Nagarkoth.      |
| 206        | — mekki,  |                               | gum,        |                                    | Surat.          |
| 207        | Halbel,   | Methi,                        | seed,       | <i>Trigonella Fœnum-græcum</i> ,   | India.          |
| 208        | Halimos,  |                               | wood,       |                                    | Surat.          |
| 209        | Hammáz barri,                                       | Epalki, Chuka,                | seed,       | <i>Rumex undulatus</i> ,           | Saháranpúr.     |
| 210        | Hamáma,   | (αμωμων),                     | leaf,       |                                    | Surat.          |
| 211        | Ditto,  | Ditto,                        | do.         |                                    | Kabúl.          |
| 212        | Himnas abíaz,                                       | Chana Kuhuli,                 | seed,       | <i>Cicer</i> —,                    | India.          |
| 213        | Himnas ahmar,                                       | Lal chana,                    | do.         | <i>Cicer arietinum</i> ,           | Do.             |
| 214        | Hinná,  | Mehadi,                       | leaf,       | <i>Lawsonia mermis</i> ,           | Do.             |
| 215        | Héntch,   | Gelúh,                        | seed,       | <i>Triticum hybernum æstivum</i> , | Do.             |
| 216        | Hanzal,   | Bislahbha,                    | root, seed, | <i>Cucumis colocynthis</i> ,       | Do.             |
| 217        | Kháb-hazí,  | Chandera,                     | fruit,      | <i>Malva rotundifolia</i> ,        | Saháranpúr.     |
| 218        | Khábbeh,  | Khábkalán,                    | seed,       | <i>Sinapis pusilla</i> ?           | Marwar.         |
| 219        | Khardal,  | Rai,                          | do.         | <i>Sinapis nigra</i> ?             | India.          |
| 220        | Khurnáb,  | (Carobs fruit),               | fruit,      | <i>Ceratonia siliqua</i> ,         | Syria.          |
| 221        | — Shami, }  |                               | do.         | <i>Cassia</i>                      | Arabia.         |
|            | — Nabati, }   |                               |             |                                    |                 |
| 222        | Khiroa,   | Arandi, Réndí,                | seed,       | <i>Ricinus communis</i> ,          | Farkh ibad.     |
| 223        | Khas,   | Kahu,                         | do.         | <i>Lactuca sativa</i> ,            | India.          |
| 224        | Khas,   | Pannu, Bena,                  | root,       | <i>Andropogon muricatum</i> ,      | Do.             |
| 225        | Khas-khášh-abíaz,                                   | Post,                         | seed,       | <i>Papaver somniferum</i> ,        | Do.             |
| 226        | — aswad,  | Pazára,                       | do.         | Ditto, red variety,                | Do.             |
| 227        | Khusyat-us-sálab,                                   | Salab-misri,                  | root,       | [Orchideæ,]                        | Kabúl.          |
| 228        | — ● —   | —                             | do.         | variety,                           | Saháranpúr.     |
| 229        | — — —   | —                             | do.         | — — —,                             | Purab.          |
| 230        | Khitni,   | Gúlkhyrá,                     | seed,       | <i>Althæa rosea</i> ,              | India, Gardens. |
| 231        | Khiláf,   | Bád múshk,                    | do.         | <i>Salix Ægyptiaca</i> ,           | Kashmir.        |
| 232        | Khandrus Mekki,                                     | Bari joar,                    | do.         | <i>Zea mays</i> ,                  | India.          |
| 233        | Kholingau,  | Kolnjar,                      | root,       | <i>Alpinia Galanga</i> ,           | Purab.          |
| 234        | *Khiár-shambar,                                     | Amaltás,                      | fruit,      | <i>Cassia fistula</i> ,            | India.          |
| 235        | *Khaeri,  | Todri saféd,                  | seed,       | <i>Cheiranthus cheiri</i> ,        | Kabúl.          |
| 236        | Dar chui,   |                               | berry,      | <i>Laurus cinnamomum</i> ,         | Purab.          |
| 237        | Dar shishaan,                                       | Kaiphul,                      | do.         | <i>Myrica sapida</i> ,             | Hills.          |
| 238        | Dar filfil,   | Pipul,                        | fruit,      | <i>Piper longum</i> ,              | India.          |
| 239        | Dalim,  | Darui, Dhármí, Anár,          | seed,       | <i>Punica granatum</i> ,           | Hills.          |

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| 240        | Dar haki,   | Amhi haldi,                  | root,      | Berberis Asiatica,         | Hills.           |
| 241        | Dānaḡ abrūj,  |                              | seed,      |                            | Sūrat.           |
| 242        | Dukhn,  | China, Kangni,               | do.        | Panicum miliaceum,         | India.           |
| 243        | Dardāb,   | Kachri, send,                | fruit,     | Cucumi,                    | Do.              |
| 244        | Darānḡ Arabi,                                       | Atis?                        | root,      | Doronicum pardalanthus,    | Arabia.          |
| 245        | Dam-ul-akhwan,                                      | (post),                      | bark,      | (gum ')                    |                  |
| 246        | Dand,   | Jamal gota,                  | seed,      | Croton tiglium,            | Pūrab.           |
| 247        | Dopaharya,  |                              | do.        | Putapetes Phœnicea,        | India.           |
| 248        | Dudhi,  |                              | plant,     | Euphorbia hirta,           | Do.              |
| 249        | — — — 2nd,  |                              | do.        | Euphorbia,                 | Delhi            |
| 250        | — — — ki jar,                                       |                              | root,      | Euph. hirta radix,         | India.           |
| 251        | Dhai,   |                              | flower,    | Grislea tomentosa,         | Do. "            |
| 252        | Dhanattar,  | Asphota?                     | seed,      | Clitoria ternatea,         | Do               |
| 253        | Deodai,   |                              | wood,      | Pinus Deodara,             | Hills.           |
| 254        | Zarch,  | Jawār,                       | seed,      | Sorghum vulgare,           | India.           |
| 255        | Razmanaj,   | Soul,                        | do.        | (substitute given.)        | Do.              |
| 256        | Rāsan,  |                              | leaf,      | Salvadora jal,             | Shamli.          |
| 257        | Rumpatri,   |                              | root,      |                            | Dakhan.          |
| 258        | Rāwand,   |                              | root,      | Rheum Emodi,               | Hills.           |
| 259        | — — — khatri,                                       | Rāwand chun,                 | do.        | — — — palmatum,            | China.           |
| 260        | Ratarḡol,   |                              | plant,     | Lathospermum vestitum,     | Delhi.           |
| 261        | — — — 2nd,  |                              | do.        | [Vorragear,]               | Do.              |
| 262        | Rivāsan,  | Jarl,                        | seed,      | Eschynomene sesban,        | India.           |
| 263        | Rumān,  | Anar,                        |            | Pomegranate fruit seed,    |                  |
| 264        | Zabib munaqqa, Kismis,                              |                              | fruit,     | Vitis vinifera, (raisins,) | Kabūl.           |
| 265        | — — — ul jabal,                                     |                              | seed,      | Delphinium?                | Sūrat.           |
| 266        | Zarāwand twil, Isarnul,                             |                              | root,      | Aristolochia longa,        | *Kashmīr.        |
| 267        | — — — mudchnaj,                                     |                              | do.        | — — — rotunda,             | Do.              |
| 268        | Zarnab,   | Bilim,                       | leaf,      | Taxus variatus,            | Hills.           |
| 269        | Zaranbād,   | Kachūr,                      | root,      | Curcuma zerasbel?          | Do.              |
| 270        | Zahm,   | Kesai, (saffron,)            | stigma,    | Crocus Cashmerianum,       | Kashmīr.         |
| 271        | Zaujabil,   | South,                       | root,      | Zingiber officinalis,      | Hills.           |
| 272        | Zāta-yābis,   |                              | plant,     | (given for hyssop.)        | Kabūl.           |
| 273        | Saj,  | Sagwān.                      | seed & l.  | Tectona grandis,           | India.           |
| 274        | Sādaj Hindi,  | Tez-pāt,                     | leaf,      | Laurus cassia,             | Hills.           |
| 275        | Sāl,  | Sāl,                         | do.        | Shorea robusta,            | Deyradūn.        |
| 276        | Sālsa, (ūshbeh) (salsaparilla)                      |                              | root,      |                            | Sūrat.           |
| 277        | Sagū dana,  | (sugo)                       | plant,     |                            | Calcutta.        |
| 278        | Sang,   |                              | fruit,     | * Minosa                   | Hansi.           |
| 279        | Sifistān,   | Laisora,                     | do.        | Cordia myxa,               | India.           |
| 280        | Satāwar,  | Satrāwal,                    | root,      | Asparagus ascendens,       | Najibabad.       |
| 281        | — — — safēd,  |                              | do.        |                            | Delhi.           |
| 282        | Satpūra,  | Burans,                      | bark,      | Rhododendron arboreum,     | foot of Hills.   |
| 283        | Sati,   | Kapūr-kachar,                | root,      | Globba ordhnoul,           | Dr yra.          |
| 284        | Sazāb,  | Sadās,                       | seed, br.  | Ruta graveolens,           | Sūrat.           |
| 285        | — — — kobī,   |                              | do.        | — — — parvillora?          | Hills.           |
| 286        | Sadā sohāgin,                                       |                              | seed, fr.  | Hibiscus Phœniceus?        | Delhi.           |
| 287        | Sadei,  |                              | plant,     | — — — composita,           | India.           |
| 288        | Sarphonka,  |                              | do.        | Galega                     | Do.              |

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|----------------|--|-----------------------------------|------------|---|---------------------|
| 289            | Sarshaf,   | Sarson,                           | seed,      | <i>Sinapis dichotoma</i> ,                            | India.              |
| 290            | <i>Sarwari</i> ,   | Chúa,                             | seed,      | <i>Celosia argentea</i> ,                             | India.              |
| 291            | Sad,   | Motha,                            | root,      | <i>Cyperus rotundus</i> ?                             | Guzerat.            |
| 292            | — 2nd,   | —                                 | do.        | — ditto,  | Delhi.              |
| 293            | Safargul, (hab)  | Bih-dana,                         | seed,      | <i>Pyrus cydonia</i> ,                                | Kashmir.            |
| 294            | Silq,  | Chokandar,                        | do.        | <i>Beta vulgaris</i> ,                                | Gardens.            |
| 295            | Salikheh,  | Taj,                              | bark,      | <i>Laurus cassia</i> ,                                | Najibabad.          |
| 296            | Sūmmāq, H.   | Kagni,                            | seed,      | <i>Panicum Italicum</i> ,                             | India.              |
| 297            | —  | —                                 | do.        | <i>Rhus toong</i> ,                                   | Hills.              |
| 298            | — (v. Arzan)   | —                                 | do.        | <i>Rhus coriaria</i> ,                                | Kabul.              |
| 299            | Simsim, semam,   | Til,                              | do.        | <i>Sesamum orientale</i> ,                            | India.              |
| 300            | Semūndar phal,   | —                                 | fruit,     | <i>Baringtonia acutangula</i> ,                       | Do.                 |
| 301            | — sokh,  | —                                 | seed,      | —   | Khadir.             |
| 302            | <i>Samar kokla</i> ,   | —                                 | galls,     | —   | Purab.              |
| 303            | <i>San</i> ,   | Mesta pāt,                        | fruit,     | <i>Hibiscus cannabinus</i> ,                          | India.              |
| 304            | Sana,  | —                                 | leaf,      | <i>Cassia senna</i> ,                                 | Agra.               |
| 305            | Sambul-ut-tib,   | Jatamansi,                        | root,      | <i>Valeriana jatamansi</i> ,                          | Hills.              |
| 306            | <i>Sans-rūi</i> ,  | —                                 | plant,     | <i>Portulacca</i> ,                                   | Delhi.              |
| 307            | <i>Sanhahūli</i> ,   | —                                 | do.        | <i>Evolvulus</i> ,                                    | India.              |
| 308            | <i>Singhara</i> ,  | —                                 | seed,      | <i>Trapa bipinnosa</i> ,                              | Do.                 |
| 309            | Suranjān shurin,   | —                                 | root,      | <i>Colchicum autumnale</i> ,                          | Surat.              |
| 310            | — — — talkh,   | —                                 | do.        | —   | Kabul.              |
| 311            | Sus,   | Mūl-hati,                         | do.        | <i>Glycyrrhiza globa</i> ,                            | Multān.             |
| 312            | Rab-us-sūs,  | —                                 | extract,   | <i>Liquorice</i> ,                                    | Arabia.             |
| 313            | — — — 2nd,   | —                                 | do.        | —   | Kabul.              |
| 314            | Sosan,   | I'rsa,                            | root,      | <i>Iris</i> ,   | Do.                 |
| 315            | <i>Sahajna</i> ,   | —                                 | seed,      | <i>Hyperanthera morunga</i> ,                         | India.              |
| 316            | Sisāliyūn,   | —                                 | do.        | <i>Sesali</i> ?                                       | Surat.              |
| 317            | Shākhul,   | Arhar,                            | do.        | <i>Cytisus cajan</i> ,                                | India.              |
| 318            | — 2nd,   | Tor,                              | do.        | — bicolor,  | Do.                 |
| 319            | Shānch dashit,   | Kanghi,                           | fruit,     | <i>Sida indica populifolia</i> ,                      | Do.                 |
| 320            | Shāh balut,  | —                                 | seed,      | substitute for <i>Acorus</i> ,                        | Hills.              |
| 321            | Shāh taraj,  | Pil papra,                        | plant,     | <i>Fumaria parviflora</i> ,                           | India.              |
| 322            | Shah hastar,   | Ryhān, 'Tulsi,                    | seed,      | <i>Ocimum pilosum</i> ?                               | Jungles.            |
| 323            | Shabit,  | Soya,                             | do.        | <i>Anethum soya</i> ,                                 | India cult.         |
| 324            | Shabibi,   | Urad ke jar,                      | root,      | <i>Phaseolus max. radiatus</i> ,                      | Surat.              |
| 325            | Shabbi,  | —                                 | seed,      | (not the seed of <i>Polyanthus</i> ),                 | Delhi.              |
| 326            | Shabu nah,   | Arlū,                             | do.        | <i>Bignonia Indica</i> ,                              | India.              |
| 327            | Sharbati,  | —                                 | do.        | <i>Ocimum</i>   | Lu know.            |
| 328            | <i>Sharifa</i> ,   | —                                 | do.        | <i>Ammon squamosa</i> ,                               | India.              |
| 329            | Shaqāqal,  | —                                 | root,      | <i>Eryngium campestra</i> ?                           | Kabul.              |
| 330            | Shukāā,  | Bādāward, p.                      | bark,      | { <i>Cratagus oxyacantha</i> , a<br>substitute given, | { Surat.            |
| 331            | <i>Shukakāi</i> ,  | —                                 | fruit,     | <i>Cassia</i> ?                                       | Purab.              |
| 332            | — 2nd,   | —                                 | do.        | <i>Mimosa</i> ,                                       | Dakhan.             |
| 333            | Shakar-i-tighāl,   | —                                 | manna,     | found on Anzerūt,                                     | Kabul.              |
| 334            | Shaljam,   | Salgram,                          | seed,      | <i>Brassica rapa</i> ,                                | India.              |

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|------------|---|-------------------------------|------------|--|------------------|
| 335        | Shonkhrán,  |                               | plant.     | { <i>Comm. maculatam</i> , sub-<br>stitute given,          | { Surat.         |
| 336        | Shonghan,   |                               | plant.     | <i>Valeriana</i> ,   | Hills.           |
| 337        | Shomuz,   | Kalounji,                     | seed.      | <i>Nigella Indica</i> ,                                    | Panipat.         |
| 338        | Shir-khisht,  |                               | manna,     | <i>Frascinus</i> ———,                                      | Kabúl.           |
| 339        | Shitaraj,   | Chita,                        | root,      | <i>Plumbago zeylanica</i> ,                                | India.           |
| 340        | Sibr,   | Elwa,                         | extract,   | <i>Aloe perfoliata</i> ,                                   | Guzerat.         |
| 341        | Sátar,  |                               | leaf,      | <i>Origanum vulgare</i> ,                                  | Persia.          |
| 342        | — 2nd,  |                               |            | ———— <i>Smyrænum</i> ,                                     | Arabia.          |
| 343        | Sanúbar saghár,                                     |                               | seed,      | <i>Pinus neoza</i> ,                                       | Auritsér.        |
| 344        | Sandal abiaz,                                       | S. sufeid,                    | wood,      | { <i>Santalum album</i> ,<br>{ <i>Syrium myrtifolium</i> , | { Dakhn.         |
| 345        | — ahmar,  | Rakat chandan,                | do.        | <i>Pterocarpus santalinus</i> ,                            | Pirab.           |
| 346        | Tábsár,   |                               | leaf,      | <i>Rhododend. aromaticum</i> ,                             | Kabúl.           |
| 347        | Tárásis,  |                               | root,      |  | Smát.            |
| 348        | Tarfá,  | Jhao,                         | berry,     | <i>Tamarix Indica</i> ,                                    | India.           |
| 349        | Akarkarha,  | Karkara,                      | root,      | <i>Anthemis Pyrethrum</i> ,                                | Calcutta.        |
| 350        | Adas,   | Masúr,                        | seed,      | <i>Eryum hirsutum</i> ,                                    | India.           |
| 351        | Aruk,   | Jáwa haldi,                   | root,      | <i>Curcuma</i>   | Bengal.          |
| 352        | Aruk-ul safi,                                       | Ambar haldi,                  | do.        | ————   | Do.              |
| 353        | — — — — —,  | Pahari haldi,                 | do.        | ————   | Hills.           |
| 354        | — — — — —,  | Pirabi do,                    | do.        | ————   | Bengal.          |
| 355        | — — — — —,  | Magla do,                     | do.        | ————   | Do.              |
| 356        | Ushbeh,   | Maghrabia,                    | berry,     | <i>Smlax</i> ,   | Arabia.          |
| 357        | Ushshar,  | Ak. madar,                    | root,      | <i>Asclepias gigantea</i> ,                                | India.           |
| 358        | Ats,  | Maju,                         | galls,     | <i>Quercus mictoria</i> ,                                  | Pirab.           |
| 359        | Enab,   |                               | fruit,     | <i>Zizyphus</i> — — —,                                     | Kashmir.         |
| 360        | Enab-ul-sálab,                                      | Bhambholan,                   | do.        | <i>Solanum nigrum</i> ,                                    | Najibabad.       |
| 361        | U'd,  | Ud Hindi,                     | wood,      | <i>Aloexylon Agallochum</i> ,                              | Hattas.          |
| 362        | — 2nd,  |                               | do.        |  | Surat.           |
| 363        | — kinari,   |                               | do.        |  | China.           |
| 364        | Gharigun,   |                               | plant,     | <i>Boletus igniarius</i> ,                                 | Kabúl.           |
| 365        | Gháfis,   |                               | do.        |  | Surat.           |
| 366        | Gul-ghafis,   |                               | flower,    | <i>Delphinium</i> ,  | Do.              |
| 367        | — — — — —   |                               | do.        | <i>Eupatorium canna hium</i> ,                             | Arabia.          |
| 368        | Ghubaera,   | Sanjad, p.                    | fruit,     | { <i>Glinus lotoides</i> ,<br>{ <i>Zizyphus giom</i> ,     | { Surat.         |
| 369        | Ghotayhia,  | Osareh reward,                | extract,   | <i>Staligmatis Gambogia</i> ,                              | Do.              |
| 370        | Fághereh,   |                               | seed,      | { <i>Xanthoxylum</i> ,<br>{ <i>Fagara piperata</i> ,       | { Najibabad.     |
| 371        | Fáwánia,  |                               | root,      | <i>Paeonia corallina</i> ,                                 | Arabia.          |
| 372        | Fujl,   | Muli,                         | seed,      | <i>Rappanus sativus</i> ,                                  | India.           |
| 373        | Farásiún,   |                               | do.        | <i>Manulea</i> ?   | Surat.           |
| 374        | — 2nd,  |                               | berry,     | <i>Anthericum Indicum</i> ,                                | India.           |
| 375        | Faranjishk,   |                               | seed,      | <i>Ocymum</i>  | Arabia.          |
| 376        | — 2nd,  |                               | do.        | ————   | Bazar.           |
| 377        | Faranj,   | Mushk Ramtulei,               | leaf,      |  | Kabúl.           |

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|-----------------|--|----------------------------------|------------------------|--|---------------------|
| 378             | Fustuk,  | Pista,                           | seed,                  | <i>Pistacia vera</i> ,                                     | Kabul.              |
| 379             | —— post birun-i-pista,   |                                  | envelopes of seed, do. |  | Do.                 |
| 380             | —— gul pista, Phul pista ka,                                   |                                  | galls,                 | Excrescences formed by insects.                            |                     |
| 381             | Fatrasakum,  |                                  | seed,                  | <i>Apium petroselinum</i> ,                                | Kabul.              |
| 382             | Fulul abriz,   | White pepper,                    | fruit,                 | <i>Piper nigrum</i> ,                                      | Dakhan.             |
| 383             | —— aswad,  | Seah mirch,                      | do.                    | Ditto,   | Do.                 |
| 384             | —— moyeh,  | Pipala mul,                      | root,                  | <i>Piper longum</i> ,                                      | Purab.              |
| 385             | Fodnaji barri,   |                                  | plant,                 | <i>Dracocephalum Royleanum</i> ,                           | Delhi.              |
| 386             | Fufal,   | Sūpyari,                         | seed,                  | <i>Arecha catechu</i> ,                                    | Purab.              |
| 387             | —— 2nd,  | S. chukni,                       | do.                    |  | Dakhan.             |
| 388             | —— gul fufal,  |                                  | gum,                   | { apparently an exuda-<br>tion on <i>Areca catechu</i> , } | Purab.              |
| 389             | Fūch,  | Manjith,                         | root,                  | <i>Rubia mangistha</i> ,                                   | Amritsér.           |
| 390             | Qaqilleh saghur,   | Choti chachi,                    | fruit,                 | <i>Elettaria cardamomum</i> ,                              | Malabar.            |
| 391             | —— kebār,  | Barri do.                        | do.                    | <i>Amomum racemosum</i> ,                                  | Purab.              |
| 392             | Qasāh,   | Kukri,                           | seed,                  | <i>Cucumis utillissimus</i> ,                              | India.              |
| 393             | Qasad,   | Khara,                           | do.                    | —— sativus,  | Do.                 |
| 394             | Qirdmann,  |                                  | do.                    | <i>Umbellifera</i> ,                                       | Kabul.              |
| 395             | —— 2nd,  |                                  | do.                    | Ditto,   | Surat.              |
| 396             | Qirasa,  | Alu balu,                        | fruit,                 | <i>Prunus cerasus</i> ,                                    | Kabul.              |
| 397             | Qasāna,  | Shoka ibrahim,                   |                        |  |                     |
| 398             | Qnā,   | Kado,                            | seed,                  | <i>Lagenaria vulgaris</i> ,                                | India.              |
| 399             | Qirfeh,  |                                  | bark,                  | <i>Laurus Cassia</i> ?                                     | Furukabad.          |
| 400             | Qarnful,   | Laoung,                          | flower,                | <i>Caryophyllus arom.</i>                                  | Purab.              |
| 401             | Qist shirin,   | Kuth,                            | wood,                  | <i>Costus</i> ,  | Amritsér.           |
| 402             | —— 2nd,  |                                  | do.                    |  | Kashmir.            |
| 403             | —— talkh,  |                                  | do.                    |  | Amritsér.           |
| 404             | Qash-ul zarreh,  | Cheretta,                        | plant,                 | <i>Swertia cheretta</i> ,                                  | Dakhan.             |
| 405             | Qutun, (hab ul)  | Buola, cotton,                   | seed,                  | <i>Gossypium herbaceum</i> ,                               | India.              |
| 406             | Qulau,   | Columba,                         | root,                  |  | Surat.              |
| 407             | Qinnab,  | Bhang,                           | plant,                 | <i>Cannabis sativa</i> ,                                   | India.              |
| 408             | Qanbul, Kambela,   | Strigose pubescence of           | fruit,                 | <i>Rottleria tinctoria</i> ,                               | Deyra Dun.          |
| 409             | Qanturyun,   |                                  | plant,                 | <i>Polycarpon armbosum</i> ,                               | Kabul.              |
| 410             | Kat,   | Katha,                           | extract,               | <i>Munosa catechu</i> ,                                    | Deyra Dun.          |
| 411             | <i>Kajuphal</i> ,  |                                  | seed,                  | <i>Anacardium occidentale</i> ,                            | Dakhan.             |
| 412             | <i>Kakrasangi</i> ,  |                                  | galls,                 | excrescence, <i>Rhus</i> ,                                 | Hills.              |
| 413             | Kāknaj,  |                                  | fruit,                 | <i>Atropa physalodes</i> ,                                 | Kabul.              |
| 414             | <i>Kala bichwa</i> ,   |                                  | root,                  | [ <i>polypodi</i> ?]                                       | Lucknow.            |
| 415             | <i>Kala kith</i> ,   |                                  | do.                    | <i>Calthoa</i> ?   | Amritsér.           |
| 416             | <i>Kali ziri</i> ,   |                                  | seed,                  | <i>Serratula anthelmintica</i> ,                           | Hillg.              |
| 417             | Kāmraj,  |                                  | berry,                 |  | Purab.              |
| 418             | Kābābeh,   | Kabāb chini,                     | fruit,                 | <i>Piper cubeba</i> ,                                      | Pali, Calcutta.     |
| 419             | Kabbar,  |                                  | bark,                  | <i>Capparis spinosa</i> ,                                  | Kabul.              |
| 420             | Ketan,   | Alsi Tisi,                       | seed,                  | <i>Tanum usitatissimum</i> ,                               | India.              |
| 421             | <i>Katai-būzany</i> ,  | Kathaela,                        | fruit,                 | <i>Solanum indicum</i> ,                                   | Do.                 |
| 422             | —— <i>khurd</i> ,  | Kathasla,                        | do.                    | —— <i>Jacquini</i> ,                                       | Do.                 |
| 423             | <i>Katol</i> ,   |                                  | root,                  |  | Delhi.              |
| 424             | <i>Kathal</i> ,  | Kental,                          | seed,                  | <i>Artocarpus integrifolia</i> ,                           | Gardens.            |



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|-----------------|--|------------------------------------|------------------|--|---------------------|
| 425             | Kuras,   |                                    | seed,            | Allium porrum,                                 | Delhi.              |
| 426             | Karafs,  |                                    | do.              | Opium graveoleus,                              | Room.               |
| 427             | Karafs bekh,   |                                    | root,            | Ditto,   | Kabul.              |
| 428             | Kirm daneh,  |                                    | gum,             | Lac,   | Bokhara.            |
| 429             | Kirmali,   |                                    | seed,            |  | Delhi (hulls).      |
| 430             | Kurúvia,   | Carraway,                          | do.              | { Carum Carui,<br>{ substitute from Kabul,)    | { Europe.           |
| 431             | Kura,  |                                    | berry,           | Echitis  | Kherbass.           |
| 432             | Kari,  |                                    | root,            | Gentiana                                       | Hills.              |
| 433             | — 2nd,   |                                    | do.              | Paderota                                       | Do.                 |
| 434             | Kúzburh,   | Dhanya,                            | seed,            | Coriandrum sativum,                            | India.              |
| 435             | Kissar ke jur,   |                                    | root,            | Aucissus ?                                     | Saháruupúr.         |
| 436             | Kasoundha,   |                                    | leaf,            | Cassia Sophora,                                | India.              |
| 437             | Kaserh,  |                                    | root,            | Cyperus tuberosus,                             | Delhi.              |
| 438             | Kasht bar kasht, Maror phali,                                |                                    | fruit,           | Helicteres ?                                   | Kheri.              |
| 439             | Kishangona,  |                                    | plant,           | Cyperus  | Delhi.              |
| 440             | Kashás,  | Akás bel ke bij,                   | seed,            | Cuscuta  | Kabul.              |
| 441             | Kahora,  |                                    | root,            | Momordica murienta,                            | India.              |
| 442             | — Ban kakora,  |                                    | do.              | { The former bears fruit,<br>{ the latter not, | { Do.               |
| 443             | Kalesar,   |                                    | fruit,           | Cucurbitaceæ,                                  | Delhi.              |
| 444             | Kamazaius,   |                                    | leaf,            | Tenacrium chamaedrys,                          | Sarat.              |
| 445             | Kamún,   | Zira síah,                         | seed,            | Cuminum Cuminum,                               | Kashmir.            |
| 446             | — safeid,  | — safeid,                          | do.              | [umbelliferae.]                                |                     |
| 447             | Kundos,  | Nak chinkhui,                      | plant,           | Artemisia sternutatoria,                       | India.              |
| 448             | — 2nd,   |                                    | root,            | An Kuth ?                                      | Hills.              |
| 449             | Kankol,  | Langoth,                           | fruit,           |  | Delhi.              |
| 450             | Kankol mirch,  |                                    | do.              |  | Dakhn.              |
| 451             | Kanoucha, [v. marv.] Kaoneh,                                 |                                    | seed,            | Dolichos pruriens,                             | India.              |
| 452             | Khatú,   |                                    | plant,           | Justicia                                       | Delhi.              |
| 453             | Khurni,  |                                    | seed,            | Mimosa kauki,                                  | India.              |
| 454             | Kaelh,   | Kath-bél,                          | fruit,           | Feronia elephantia,                            | Do.                 |
| 455             | Gaj pipal,   |                                    | do.              | Pothos scandens,                               | Hills.              |
| 456             | Gangeran,  |                                    | bark,            | Grewia hirsuta,                                | Kheri, Delhi.       |
| 457             | Gayán dhúl,  |                                    | plant,           | [fungi.]                                       | Doonab.             |
| 458             | Gul-machkan  |                                    | flower,          | Platyspermum ?                                 | Hills.              |
| 459             | Giloh,   |                                    | berry,           | Menispermum cordatum,                          | India.              |
| 460             | — Sath giloh,  |                                    | fecula of ditto, |  | Do.                 |
| 461             | Gihunle,   |                                    | seed,            |  | Amritsér.           |
| 462             | Gudachla,  |                                    | plant,           |  | Delhi.              |
| 463             | Ghumohi safeid,  |                                    | seed,            | Abrus precatorius,                             | India.              |
| 464             | — surkh,   |                                    | do.              | Do.  | Do.                 |
| 465             | Gilar patri,   | Goitre leaf,                       | leaf,            |  |                     |
| 466             | Latori,  |                                    | plant,           |  |                     |
| 467             | Lihyat-ut-tés,   |                                    | extract,         | an Cytus Hyporistus,                           | Delhi.              |
| 468             | Lesán-us-saur,   | Gao zaban,                         | root,            |  | Do.                 |
| 469             | — — — — —  | Sankaholi,                         | plant,           | Onosma bractiata,                              | Kabul.              |
| 470             | Lesán-ul-saur, (gul,   |                                    | flower,          | Boraginæ,                                      | Ghulan.             |

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|----------------|--|---------------------------------|------------|----------------------------|---------------------|
| 471            | Lisân-ul-haml, Bártang,                                      |                                 | seed,      |                            | Kabûl.              |
| 472            | — al-asâfir, indarjao shirin,                                |                                 | do.        | Echites antidysenterica,   | Pûrab.              |
| 473            | Luffâ,   |                                 | root,      | Atropa mandragora,         | Surat.              |
| 474            | Lakmana,   | Lakmani,                        | plant,     |                            | Delhi.              |
| 475            | Lodh,  |                                 | bark,      | Symplocos racemosa,        | Hills.              |
| 476            | Louz-hulûv,  | Badâm shirin,                   | seed,      | Amygdalus communis dulcis, | Kabûl.              |
| 477            | — mur,   | Badam karwa,                    | do.        | — amara,                   | Do.                 |
| 478            | Mazareyân,   |                                 |            |                            |                     |
| 479            | Mâl-kangni,  |                                 | do.        | Celastrus nutans,          | India.              |
| 480            | Mâmisa,  |                                 |            |                            |                     |
| 481            | Mâmirân,   | (2nd kind),                     | root,      | Ranunculus Ficara,         | Kashmir.            |
| 482            | Manas rohani,  |                                 | leaf,      | Myrsine bifaria,           | Hills.              |
| 483            | Mâlû-danch,  |                                 |            |                            |                     |
| 484            | Mâhi zaharaj,  |                                 |            |                            |                     |
| 485            | Mirchai,   | Kawa thonthi,                   | seed,      | Ipomoea                    | India.              |
| 486            | Mirch kal,   |                                 | fruit,     | Capsicum pubescens,        | Do.                 |
| 487            | Marzan-jush,   |                                 |            |                            |                     |
| 488            | Marv,  | Kanouncha,                      | seed,      | Hippophae salicifolia,     | Kabûl.              |
| 489            | Mar hari,  | Maror phali,                    | fruit,     | Helicteres scabra,         | Kherr.              |
| 490            | Mishk-tarâ-mashih,   |                                 | wood,      | Dictamnus fraxinella,      | Baghdad.            |
| 491            | Moghâs,  | Maeda lakri,                    | seed,      | Tetranthes,                | Kabûl.              |
| 492            | — 2nd,   |                                 |            |                            |                     |
| 493            | Makhareh,  |                                 | seed,      | Euryale ferox,             | Patna.              |
| 494            | Malim,   |                                 | r. and br. |                            | Hills.              |
| 495            | Mor-pankhi,  |                                 | plant,     | Pteris palmata,            | Delhi.              |
| 496            | Musli safed,   |                                 | root,      |                            | Dakhan.             |
| 497            | — 2nd,   |                                 | do.        |                            | Gualior.            |
| 498            | — safed, Sembhal ki musli,                                   |                                 | do.        | Bombax heptaphyllum,       | India.              |
| 499            | — seah,  |                                 | do.        | Commelina scapiflora,      | Kheri.              |
| 500            | Mûndi,   |                                 | plant,     | Sphueranthus Indicus,      | India.              |
| 501            | Maeda lakri,   | Chandan,                        | bark,      | Tetranthera spitala,       | Almora.             |
| 502            | Nârijil,   | Naryel,                         | seed,      | Cocos nucifera,            | Bengal.             |
| 503            | — bahri,   | Daryai naryel,                  | do.        |                            | Surat.              |
| 504            | Nâr-mushk,   | Nag kesar,                      | flower,    | Manna ?                    | Guzerat.            |
| 505            | Nân khwâh,   | Ajwain,                         | seed,      | Legusticum ajwain,         | India.              |
| 506            | Nah,   |                                 | plant,     | [rubaceæ],                 | Delhi.              |
| 507            | Nirgandhi,   |                                 | root,      |                            | Dakhan.             |
| 508            | Nirmali,   |                                 | seed,      | Strychnos potatorum,       | Do.                 |
| 509            | Nigand, bâhari,  |                                 | plant,     |                            | Delhi.              |
| 510            | Nimb,  | Nim,                            | seed,      | Melia azadirachta,         | India.              |
| 511            | Nil,   | Nil,                            | do.        | Indigofera tinctoria,      | Do.                 |
| 512            | Nil-kunthi,  |                                 | plant,     | Ajuga                      | Delhi.              |
| 513            | Nylofar,   | Bhambhûl,                       | flower,    | Nymphaea                   | India.              |
| 514            | Wuj,   | Bach,                           | root,      | Acorus Calamus,            | Khorasân.           |
| 515            | Ward,  | Gulâb,                          | fruit,     | Rosa damascena,            | India.              |
| 516            | Halha jori,  |                                 | plant,     | Polypodium,                | Lucknow.            |
| 517            | Hûlhûl,  |                                 | seed,      |                            |                     |
| 518            | Halyân,  |                                 | fruit,     | Asparagus officinalis,     | Surat.              |

## Resins, Gums, and Gum-resins.

| Arabic name.   | Synonymes.   | Botanical name of plant.         |                  |
|--|--|----------------------------------|------------------|
| 1 Ushaq, Kándar,   | Ammoniacum ushk,   | from <i>Heraclea gunnifera</i> , | Kabúl.           |
| 2 Auñr ki gond,  |  |                                  |                  |
| 3 Anzerút,   | Sarcocoll,   | <i>Pinea sarcocolla</i> ,        | Do.              |
| 4 Bárzad, gauda heroza,  | Galbanum,  | <i>Babon Galbaniferum</i> ,      | Hills.           |
| 5 <i>Pa-lam ki gond</i> ,                                      |  | <i>Prunus puddum</i> ,           | S. B. G.         |
| 6 <i>Pachdhara do.</i>   |  | <i>Euphorbia angularis</i> ,     | Do.              |
| 7 Taranj bin, Persian manna,                                   |  | <i>Alhagi Maurorum</i> ,         | Kabul.           |
| 8 <i>Tun ki gond</i> ,   |  | <i>Cedrela Toona</i> ,           | India.           |
| 9 ————   |  |                                  |                  |
| 10 Jawashur, gaoshir p.  | Gum opopanax,  | <i>Pastinaca opopanax</i> ,      | Arabia.          |
| 11 <i>Jingon ki gond</i> , Kam gond,                           |  | <i>Icica gummifera</i> ,         | Kheri pass.      |
| 12 Dam ul-akhwain, Hira dukhi, Khún & kharábá, Dragon's blood, | <i>Diacaena draco</i> , <i>Calamus rotang</i> , & <i>Pterocarpus draco</i> , |                                  | Surat. & Arabia. |
| 13 Rátúnaj,  | Rajina, Colophony "  | <i>Bursera pauciflata</i> ,      | Surat.           |
| 14 Zard álu ki gond,   |  | <i>Prunus chinlooi</i> ,         | S. B. G.         |
| 15 Zift,   | Resin, pitch,  |                                  | Room.            |
| 16 <i>Saleh ki gond</i> , Kundau "                             |  | <i>Boswellia serrata</i> ,       | Kheru.           |
| 17 Sakmunya,   | Scammony,  | <i>Convolvulus scammonia</i> ,   | Surat.           |
| 18 ———— 2nd,   |  |                                  | Do.              |
| 19 Sakbinaj,   | Kandal Sagapennu,  | <i>Ferula persica</i> ,          | Arabia.          |
| 20 Saudrús,  | Chaudrús, Sandarach,   |                                  | Marwar.          |
| 21 ———— 2nd,   | Kharwa, Copal,   |                                  |                  |
| 22 <i>Sahajne ki gond</i> ,                                    |  | <i>Hyperanthera morunga</i> ,    | India.           |
| 23 <i>Siris ki gond</i> ,                                      |  | <i>Mimosa senica</i> ,           | Do.              |
| 24 <i>Sem ki gond</i> ,  | Gota gond,   | <i>Bauhinia gummifera</i> ,      | Dehra.           |
| 25 Sembal ki gond,   | Mochrus,   | <i>Bombax heptaphyllum</i> ,     | India.           |
| 26 Sibr,   | Elwa, musabba,   | <i>Aloe perfoliata</i> ,         |                  |
| 27 Samgh Arabi,  | Gum Arabic,  | <i>Acacia vera</i> ,             | Arabia.          |
| 28 Elk-ul-bútú,  | Chian turpentine,  | <i>Pistacia Terebinthus</i> ,    | Surat.           |
| 29 Farfiyun, afabiyyún,  | Euphorbium,  | <i>Euphorbia officinarum</i> ,   | Arabia.          |
| 30 <i>Karch</i> ,  | Nál,   | <i>Shorea robusta</i> ,          | Kheru.           |
| 31 Kirásia,  | Cherry gum,  | <i>Prunus cerasus</i> ,          | Surat.           |
| 32 Katura, Kasira, Katila,                                     | Gum tragacanth,  | <i>Bombax gossypium</i> ,        | Kheru.           |
| 33 Kundur,   | Lobán, Olibanum,   |                                  | Surat.           |
| 34 ———— 2nd,   | Frankincense,  | <i>Juniperus Lycia</i> ,         | Punab.           |
| 35 <i>Kaeni gond</i> ,   |  |                                  |                  |
| 36 <i>Kamarkas</i> ,   | Dhawe ki gond,   | <i>Butea frondosa</i> ,          | India.           |
| 37 <i>Khaer ki gond</i> ,                                      |  | <i>Mimosa catechu</i> ,          | Deyra.           |
| 38 Kah raba,   | Amber,   |                                  | Hills.           |
| 39 Ladan, lázan,   | Ladbanum,  | <i>Cistus ladaniferens</i> ,     | Surat.           |
| 40 Lák,  | Lák, Láh, Gum Lac,   | <i>Coccus lacca</i> ,            | Seharánpúr.      |
| 41 Múr,  | Bol, Myrrh,  |                                  | Surat.           |
| 42 Mustaká,  | Mastich,   | <i>Pistacia lentucus</i> ,       | Kabul.           |
| 43 Moql,   | Gogal,   | <i>Bdellium</i> ,                |                  |
| 44 ———— 2nd,   | ——— 2nd,   |                                  | Hills.           |
| 45 Nágauri gond,   |  |                                  | Nagore.          |

VII.—*Proceedings of the Asiatic Society—Physical Class.**Wednesday Evening, 3rd October, 1832.*

Sir EDWARD RYAN, President, in the Chair.

The proceedings of last Meeting were read and adopted.

*Library.*

The following books were presented :

“ *Fragmens de Geologie et de Climatologie Asiatiques*, par A. De Humboldt,” in 2 volumes. *From the Author.*“ *An English Index of Indian Plants*, by H. Piddington, Esq. Foreign Sec. Agricultural Society, Calcutta, 1832.” *From the Author.*

This very useful compendium has been drawn up with great industry from all the available sources of information. The native synonyms include many corruptions from the right reading, which have found their way into Botanical works : it might perhaps have been an improvement that the correct word should have been distinguished from the rest, and spelt according to some constant system of orthography.

*Museum.*

The Secretary announced the receipt of the fossil shells of the Paris basin, of the tertiary formations of Italy and Sicily, as well as from Diablerets in Switzerland, and specimens of the bone breccia of Nice, alluded to at the last Meeting, in a letter from Dr. Turnbull Christie, of Madras.

The shells are in the highest preservation, and will form a most useful series for reference on all occasions. A catalogue will be published in the Society's Journal, that members at a distance may be aware what fossil shells are in our possession.

A letter was read from Mr. James Calder, Vice-President, presenting in the name of C. Telfair, Esq. President of the Mauritius Natural History Society, the following geological specimens and minerals :

1. *Mammellated black oxide of Manganese*, found in a state of great purity, and in vast quantities, in the interior of Madagascar.
2. *Capilliform Obsidian*, (Actynolite?) from Bourbon. After the last eruption of the volcano in that island, the country for miles round was found to be covered with crystals of green actynolite, like a hoar-frost, which from its appearance received the name of Neptune's hair.
3. *Petrified wood and fossil shells*, from Basse's Straits and New Holland.

Unfortunately the labels on these are lost, which is the more to be regretted, as the shells and their matrix resemble very closely those from the Himalaya : especially two, which are identical with Nos. 22 and 25 (*Producta* and *Spirifer*?) of Mr. Everest's Plate, in the Trans. Phys. Cl. 2nd Part.

4. *Asbestos* ; veins in serpentine—locality not specified.

A letter was read from Dr. G. G. Spilsbury, dated Jabalpur, 7th September, presenting three specimens of the fossil bones recently discovered in that neighbourhood.

The Secretary read a note upon the subject, which appears in the present number.

ological notice was submitted, explanatory of a series of specimens collected between the plains of Assam and Chirā Punjī, in the Kasya mtaīns, and presented to the Society by W. Cracroft, Esq. through the President.

Two boxes, containing 415 specimens of different kinds of wood, from India, Assam, Ava, Arracan, the Cape of Good Hope, Australia, and Pitcairn's Island, with a catalogue describing their native and Botanical names, was presented by Captain Baker, Superintendent of Iron Suspension Bridges.

Captain Baker has just completed an elaborate series of experiments on the strength and elasticity of these woods, of which a partial account was printed in the GLEANINGS. The paper will appear in the RESEARCHES.

A model of Theodore Jones and Co.'s new Patent Suspension Wheels, with a full description of their various advantages, was presented by Lieut. Col. Watson.

Of this invention, we shall give a particular account in our next.

*Papers read.*

1. Note on the Saline Deposits near Cawnpūr. By Mr. H. H. Spry.

This paper will appear in our next.

2. On the Ice Manufactory at Hughli. By Dr. Wise.

3. Report on the present state of the Boring in Fort William. By Dr. Strong.

The holidays had for a period suspended proceedings, and the overseer was employed in making up a claw and spring tool for the extraction of the rods, which had again unfortunately broken in the second shaft, at a depth of 130 feet. This accident had frequently occurred from the falling in of the sand, notwithstanding the protection afforded by the tubing of the present shaft. It would, probably, be necessary to withdraw the tubes to get hold of the rod; in which case, Dr. Strong proposed to replace them carefully, and proceed with the perforation: but, for this a further supply of cash would be requisite; the last grant of 500 being expended, and money being still due to the workmen.

A motion by Dr. Strong, seconded by Mr. D. Ross, that 500 rupees should be granted unconditionally for the continuation of the experiment, was negatived: an amendment was proposed by Mr. Wilson, and carried, "that the Committee recommend to the Society to make a further grant of 500 rupees to the gentlemen in charge of the Boring experiment, on the express condition, that it shall be the last, unless they shall be then able to shew convincing proof, that its further prosecution will be attended with success."

4. Report of the Sub-Committee, on the subject of the proposed extension of the Museum.

The Report pointed out the difficulty of furnishing suitable accommodation for a resident curator on the premises, and proposed instead, that a small house in the immediate neighbourhood should be hired, in which all the preparations of the specimens could be made, leaving the whole of the lower floor of the Society's premises open for their reception. The expence of this arrangement, including the contingents of making and altering cabinets, stuffing, &c. was estimated at 200 rupees per mensem. After some discussion, the report was referred back to the Sub-Committee, to inquire what means exist to meet such an expenditure, before going before the Society with the proposition.

VIII. — *Notices in Natural History.* By Lieut. T. Hutton, 37th N. I.

The commencement of the rainy season is the period of vital activity among the insect creation : their rapid and prolific increase presents some of the most astonishing facts among the wonders of nature : it seems as if every avenue of comfort and health would be choked up and destroyed by the millions which crowd into existence ; but means are wisely ordained to preserve each link of the chain of nature in equilibrium with the rest : thus beasts prey upon beasts, birds on birds and on insects, and these upon other species, so that the various tribes of living beings are kept within the limits which the purposes of their creation require. I will adduce a few instances of this amazing increase which have just fallen under my view.

1. *Ova of the Spider.*

A lad, whom I employ to bring specimens for my museum, brought me a small white ball, about the size of a pen, which proved to be the silky bag with which some spiders envelope their ova. It was closely constructed of silky threads, strongly interwoven, and glazed on the exterior, for the purpose probably of guarding against moisture. At first sight, its contents appeared to be small white eggs, but on closer inspection, I found them to be young spiders seemingly fully formed, at least as far as I could determine with a tolerable magnifier.—I then took a needle, and drew them forth one by one to the surprising number of *three hundred and ten* living spiders.

What numbers of insects must be destroyed to furnish this vast increase with food, while they themselves will in turn fall a prey to birds, &c. before the period of ovipositing shall again arrive ; and immense as the increase from one pair of spiders appears, yet having aided in keeping other families within their proper limits, perhaps not one in a hundred will survive to perpetuate the race.

2. *The Scorpion.*

The second instance I shall notice was a scorpion—*Scorpio Afer* ? Pecten with 15 teeth ; eyes 8 ; colour dark bottle-green ; legs and poison sack dirty straw-colour ; claspers or forceps tuberculated—length 3½ inches.

The above was dug out of a hole in the ground ; it had ten young ones clinging about it ; these were a quarter of an inch long, and perfectly white, very soft, and the sting not perceptible through a magnifier, although the poison sack was formed—the point, where the sting should be, being quite obtuse in the whole of the young ones.

3. *Fresh-water Crab.*

The third and last instance which I shall at present advert to, was a fresh-water crab, which I found in a small hole, apparently that of a mouse, at the foot of a tree, and which for the present I have referred to the genus *Thelphusa*, LAT.

This had the two exterior antennæ placed at the base of the ocular peduncles ; jaw feet covering the mouth ; legs 8 ; forceps of equal size nearly, with a spine on the second joint ; shell cordiform, and truncated posteriorly, slightly wrinkled on the side with a short spine anteriorly, near the eyes ; colour greenish or livid grey above, dirty white beneath ; a mark in form of an impressed X on the back, and two rows of small white spots placed in parallel lines at the anterior part of the shell, viz. two spots in the first line and four in the second, thus \* \* \* \* \*. On lifting the ventral plate, if I may so term it, in which the ova are found, I count-



taken as a distinguishing mark, will amount to many more species than I have hitherto found described in any author I have been able to consult.

I had intended sending a drawing of the *Nepa grandis*, but not being able to delineate it myself with sufficient accuracy, I have been obliged to delay it, until I can get it drawn correctly.

## IX.—Miscellaneous Intelligence.

### 1. Roman Coins in Upper India.

In a letter published in the *India Gazette* of the 19th October, Dr. R. Tytler mentions that many of the *Diocletian* coins noticed in the catalogue of the Society's Cabinet were presented by himself, and that they were collected at *Allahabad*, *Mirzapur*, and *Boudhal*. His inference is, that they were brought to India by Christian emigrants, during the ten years' persecution which occurred in the reign of that Emperor, and that some of the doctrines of the Christian religion were then engrafted upon the superstitions of Hindustán. The coins of *Caraus* and *Numerianus* were from *Mirzapur* and *Chunar*: and another of *Diocletian's* was procured at Kanouj. If diligent inquiry be made in that part of India, probably an extensive collection of coins of the third century may be made. More remains of the sort will naturally be discovered in the neighbourhood of ancient towns, and the most prevalent date of the coin will in some way prove the period at which these cities were in the most flourishing condition. P.

### 2. Spontaneous Combustion of Coal.

On Friday, the 26th instant, smoke was observed to issue from the hold of the *London*, one of the ships severely handled in the late storm, which on examination was found to proceed from 300 tons of coals then on board that vessel. Means were taken to discharge the cargo, and the river engines were kept at work for two days and nights, pumping water in to swamp the ignited mass: the only damage sustained was in one of the pillars of the lower deck, which was nearly burned through. A portion of the coal was examined by Mr. Ross, of the Mint, and found to contain a considerable portion of pyrites: this mineral by the action of water and air is rapidly converted into sulphate of iron, and develops sufficient heat, when the mass is large, to ignite the coal: frequent accidents of the same nature have before happened. The steamer *Emulous* on sailing from England was forced to put back on account of the ignition of the coal stores. H. M. Ship *Ajax* is supposed also to have been destroyed in the same way. Commanders of vessels should take particular care that coals taken on board are quite dry, and shew no yellow veins or nodules: and they should not be placed where they are liable to be wetted, nor too near the powder magazine.

### 3. Transit of Mercury observed in England.

The 5th of May proved in England, as in India, a cloudy day. The planet was seen only thrice on the sun's disc by Mr. Barker of Deptford, and then only for intervals of two or three seconds: the spectacle therefore, as that observer writes in the *Literary Gazette*, was more gratifying than satisfactory in a scientific point of view. At 9h. 1m. A. M. Mercury was seen advanced about half his diameter on the disc. 9h. 3m. was observed to be the period of the first internal contact; but it is not mentioned whether the chronometer employed was at mean solar, or apparent time.



4. *Rain at Chira Pungl, from 1st September to 8th October, 1832, registered by W. Cracroft, Esq.*

|    | inches.  |    | inches. |                      |             |
|----|----------|----|---------|----------------------|-------------|
| 1  | 1.195    | 16 | 0.305   | 1                    | 0 000       |
| 2  | 1.117    | 17 | 1 050   | 2                    | 0.000       |
| 3  | 1.575    | 18 | 6.375   | 3                    | 0 000       |
| 4  | 2.510    | 19 | 1.850   | 4                    | 0.000       |
| 5  | 4 680    | 20 | 0.130   | 5                    | 0.125       |
| 6  | 1.689    | 21 | 0 760   | 6                    | 0 000       |
| 7  | 0.000    | 22 | 0.985   | 7                    | 3.015       |
| 8  | not mea. | 23 | 4 600   | 8                    | 12 650      |
| 9  | 4 232    | 24 | 5.010   | Rain in Sept.        | 55 309      |
| 10 | 9.494    | 25 | 0 000   | In 2 days of Oct.    | 15 710      |
| 11 | 6.332    | 26 | 0 010   | Already regt.        | 151 690     |
| 12 | 0.000    | 27 | 0.000   |                      |             |
| 13 | 0.085    | 28 | 1.235   | in four months,      | 225.789 in. |
| 14 | 0.000    | 29 | 0.000   | Maximum temperature, |             |
| 15 | 0.000    | 30 | 0.000   | 16th.... 81° 5'      |             |
|    |          |    |         | Minimum, 29th.... 60 |             |

5. *Electric Spark from the Magnet.*

The modes in which Sig. Nobili, in Italy, Mr. Faraday, and Mr. Ritchie, in London, and Mr. Forbes in Edinburgh, have successively arrived at this satisfactory result of their researches, are now given to the world.

Signor Nobili was the earliest in point of date, but he was led to the discovery of the spark entirely by the theoretical views and previous experiments of Mr. Faraday, who also arrived at the same conclusion immediately after, and without a knowledge of his rival's labours. The apparatus necessary to display the phenomenon is exceedingly simple. The following are the views upon which it is framed.

"The voltaic pile gives a spark only when composed of a certain number of pairs of plates. A single Wollaston's voltaic element yields it; and when of a certain activity, produces it constantly at the surface of the mercury, to which the conjoining wires destined to close the circuit are conducted. In the voltaic pile, having a certain degree of *electric tension*, the sparks pass between the zinc and copper poles, either in the case of opening or of closing the circuit. In a single Wollaston's element, the tension is feeble and the spark occurs only when the circuit is interrupted. At that moment, the current, which was before moving, accumulates as it were at the place of interruption, and acquires the intensity necessary to cause the spark. Such tension is wanting in the other case of closing the circuit, and the spark also is absent.

"The currents developed in the electro-dynamic spirals by virtue of magnetism are also in motion, but circulate only for the moment during which they are approaching to or receding from the magnets.

"It was, therefore, Sig. Nobili and Antinori concluded, in one of those two moments that the circuit ought to be opened in making the experiment for the spark."

*Experiment.* A coil of wire is wound round the cross-bar or armour of a horse-shoe magnet; the ends of the wire are brought away to a short distance from the bar, and bent so as to meet; and, to ensure their contact, a disc is attached to the extremity of one wire, upon which the point of the other impinges at right angles: the contact is then made perfect by amalgamation with mercury. When the bar is separated from the magnet or brought to it, the jerk at contact separates the points of the wire for an instant, and a *spark* is seen to pass from one to the other, and when the armour is suddenly removed it is again visible: the experiment may be repeated at pleasure.—*Phil. Mag.* lxi. 406.

*Menological Register, kept at the Surgeon General's Office, Calcutta, for the Month of October, 1832.*

| Days of the Month. | Minimum Temperature observed at sunrise. |                     |                        |       |                    | Maximum Pressure observed at 9h. 50m. |                     |                        |       |                    | Max. Temp. and Dryness observed 2h. 40m. |                     |                        |       |                    | Minimum Pressure observed at 1h. 0m. |                     |                        |       |                    | Observations in tide at sunset. |                     |                        |       |                    | Observations at 1 P. M. |                    |  |  |  |
|--------------------|--|---------------------|------------------------|-------|--------------------|---------------------------------------|---------------------|------------------------|-------|--------------------|--|---------------------|------------------------|-------|--------------------|--------------------------------------|---------------------|------------------------|-------|--------------------|---------------------------------|---------------------|------------------------|-------|--------------------|-------------------------|--------------------|--|--|--|
|                    | Barometer reduced to 32°.                | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°.                   | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°.                      | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°.                  | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. | Barom. red. to 32°.             | Temper. of the air. | Depres. of M. B. Ther. | Wind. | Aspect of the sky. | Rain Gauge, No. 1.      | Rain Gauge, No. 2. |  |  |  |
| 1                  | 29.807                                   | 79.                 | 1.8                    | n.    | cu.                | 30.188                                | 86.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 2                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 3                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 4                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 5                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 6                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 7                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 8                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 9                  | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 10                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 11                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 12                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 13                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 14                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 15                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 16                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 17                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 18                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 19                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 20                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 21                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 22                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 23                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 24                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 25                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 26                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 27                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 28                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 29                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 30                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| 31                 | 29.799                                   | 78.5                | 1.3                    | n.    | cu.                | 30.188                                | 85.                 | 8.1                    | n.    | cu.                | 29.722                                   | 85.7                | 7.2                    | n.    | cu.                | 29.726                               | 85.5                | 7.3                    | n.    | cu.                | 30.188                          | 84.1                | 8.1                    | n.    | cu.                | 0.28                    | 0.22               |  |  |  |
| Mean.              | 29.837                                   | 74.7                | 1.6                    |       |                    | 30.188                                | 85.5                | 8.1                    |       |                    | 29.722                                   | 85.7                | 7.2                    |       |                    | 29.726                               | 85.5                | 7.3                    |       |                    | 30.188                          | 84.1                | 8.1                    |       |                    | 0.28                    | 0.22               |  |  |  |

*Note.*—On the 7th it blew a heavy gale, beginning in the north-east, and veering round to east, south, and south-west. As the Barometers was much affected thereby, its altitude on that day is omitted in the monthly averages.

# JOURNAL

OF

## THE ASIATIC SOCIETY.

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No. 11.—November, 1832.

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I.—*Notice of the peculiar Tenets held by the followers of Syed Ahmed, taken chiefly from the “Sirât-ül-Mustaqîm,” a principal Treatise of that Sect, written by Moulavî Mahommed Ismail.*

THE *Sirât-ül-Mustaqîm*, or “The True Path,” is the most important of several treatises which have been composed by followers of Syed Ahmed, the modern Mahommedan zealot and reformer, with whose name the European public has recently become familiar. It gives also the fullest account generally known of his tenets and pretensions. The interest attaching to his personal pretensions, has in a great measure ceased with his death, but the influence of his tenets still continues extensive, being understood, indeed, to have reached to almost all parts of India; and the subject is one which deserves attention, with reference to the marked distinction of opinions and usages which has arisen between those who have adopted his doctrines, and the mass of the Mahommedan population of the country. A subordinate portion only of this work is devoted to a statement of such opinions as affect points of common and obvious usage; but it is respecting these that curiosity may generally be supposed to exist. The main object of the author in composing it was, in the first instance probably, to shew his own learning; in the next, to justify the claims of Syed Ahmed, (of whom he was a constant and confidential adherent,) as a devotee, gifted with a surpassing degree of religious capacity and illumination. Its professed purpose is, kindly to impart to the world the benefits of the experience and inspired discoveries of a saint so eminent as Syed Ahmed was proclaimed to be, in those modes of religious exercise which are believed by the most orthodox Mahommedans to have an influence in purifying and strengthening the higher orders of human minds, which enables them, even in life, to attain to a

knowledge of the hidden meaning and essence of the institutes of their faith, to an intimate communion with the immediate presence of the Divinity, and to the most exalted state of spiritual dignity and power. The whole is written in a strain of what may most appropriately be termed Orthodox Súfism. Touching but little on the metaphysical subtleties of the Súfí opinions, and utterly denouncing such of their professors as are not strict believers, it is still devoted to an exposition of many of the admitted Súfí tenets and practices, and is full of the technicalities of Súfí phraseology. It makes reference especially, in its explanations and allusions, to the peculiar divisions which prevail in India, among those who aspire to the honours of religious initiation. These are generally numbered as the followers of one or other of three venerated *Pírs*, each of whom has given a name to a distinct school or sect; the first, the "*Taríqa-i-Qádiríá*," which traces its origin to *Abdul Qádir*\* *Jílani*, of *Jilan*, or Ghilan. Another, the "*Taríqa-i-Chishítá*," so called from its founder *Khwája Múin-ud-dín Chishtí*, whose tomb† is at Ajmere; the third, the "*Taríqa-i-Nakshbandíá*," derived from a *Khwája*‡ *Bahá-ud-dín Nakshband*, a native of Bokhára. It was one of the peculiar pretensions of *Syed Ahmed*, that he held himself privileged, instead of confining himself, as is usual, to giving admission to one only of these schools, to receive followers at his pleasure into any, or into all of them, and he aimed also at becoming the founder of a school of his own, to which he gave the appellation of the "*Taríqa-i-Muhammediá*."

It was not, however, to exercises of speculative piety, that this aspiring adventurer chiefly trusted to gain himself reputation and influence among his Mahommedan countrymen. The whole object of his career was to rouse and unite Mahommedan feeling in support of his own views of fanaticism and aggrandisement; and he naturally employed for that purpose methods more likely to have a generally active effect. The following sketch of the principal events of his career, and of the means by which he sought to obtain distinction, taken from the written or oral accounts generally current, may not be without interest, before proceeding to the detailed description of the peculiarities of belief and practice which his followers have adopted from him.

He began life in an indifferent school for the character of reformer and saint, which he ultimately assumed, as a suwar serving

\* The name at full length, with all its titles, is *Ghous-ul Azim Mahí-ud-dín Abdúl Qádir Jílani*. Born 471, Híjrí. Died 561, Híjrí.

† Died 633, Híjrí.

‡ Born 718, Híjrí. Died 791, Híjrí.

with Amír Khán's free-booting horse in Málwa. Quitting that service, about the time when the body of Amír Khán's followers was disbanded, he repaired to Delhí, and became a disciple of Shah Abdúl Aziz, a very celebrated devotee of the city; the fame of whose knowledge and piety has been widely extended throughout this side of India. It is frequently said by Natives, that it was from Sháh Abdúl Aziz, that Syed Ahmed derived the peculiar opinions which he subsequently promulgated, and the design which he adopted of preaching up a religious crusade. It is at least certain, that the chief of his first disciples, and the most constant associates of all his fortunes, were two near relatives of Abdúl Aziz, one his nephew, and the author of this work, named Moulaví Muhammed Ismail, the other his son-in-law, and also partially a contributor to the book, named Moulaví Abdúl Hye. Of these persons, Muhammed Ismail is generally esteemed to have been a man of much talent and learning. The extreme honour which he and his brother Moulaví paid to Syed Ahmed, who was himself nearly illiterate, had a powerful effect in attracting towards him the respect of the vulgar. They rendered him almost menial offices, running, it is said, with their shoes off, by the side of his palankeen, when he moved out, like common servants. Attended by them, he set out from Delhí on his way to Calcutta, and thence on the sacred duty of a pilgrimage to Mecca. He chose a circuitous route for the purpose; for he is said to have first gone north to Sháranpúr, and then west with a sufficiently intelligible motive to Rámpúr; the jagheer held by the descendants of the Rohilla chief, Fyzúlla Khan, and the seat of a large body of turbulent Patháns. From his first leaving Delhí, he assumed the character of a religious teacher, and commenced spreading his reforming doctrines. The general spirit by which these were animated, (identical nearly with that of the tenets of the Arabian Wahabís, of whom the sect of Syed Ahmed may perhaps be accurately termed an Indian imitation,) was the ardent profession of Mahomedanism in its primitive simplicity and fervour, and the utter rejection of all idolatrous or superstitious innovations, whencesoever derived. It is obvious, that such tenets were well calculated to awaken the sincerity of religious zeal, and to gratify the pride of Mahomedan feeling; while, on the other hand, they were likely to meet with much opposition in the influence of long established customs and indulgencies. The manner in which they were at first actually received was however highly favourable. When Syed Ahmed at last came down to Bengal, he had got together many followers, and had established an extensive reputation. He arrived in Calcutta with a considerable

retinue towards the end of 1821, and immediately a great majority of the Mahommedans of the place, of all ranks and stations, flocked to become, or to profess themselves, his disciples. In the early part of 1822, he proceeded with his friends, the two Moulavis, to Mecca, from whence he returned in October of the next year, having touched for a few days at Bombay, where, with reference to the shortness of his stay, his success, in gaining numerous followers, was nearly as remarkable as in Calcutta. In December, 1823, he again started for Upper India. The next important event of his career, his commencing a religious war in the Lahore territories, did not occur till after a considerable interval, though the enterprise was one in which he had long openly announced his intention to engage. Its date is given in the following extract from the "*Targhīb-ul Jihād*," or "Incitement to Religious War," a little treatise written in Hindustani during the continuance of the struggle, by a Moulavi of Kanouj, with the view, as its name purports, of rousing the Faithful to rally round the standard which had been raised in the Panjáb. "The tribe of Sikhs," says the indignant Moulavi, "have long held sway in Lahore and other places. Their oppressions have exceeded all limits. Thousands of Mahommedans they have unjustly killed, and on thousands have they heaped disgrace. The '*Azán*,' or summons to prayer, and the killing of cows, they have entirely prohibited\*. When at length their insulting tyranny could no longer be borne, Hazrat Syed Ahmed, (may his fortunes and blessings be permanent!) having for his single object the protection of the faith, took with him a few true Mussulmáns, and going in the direction of Kabúl and Pesháwar, succeeded in rousing the Mahommedans of those countries from their slumber of indifference, and nerving their courage for action—Praise be to God—some thousands of believers became ready at his call to tread the path of God's service; and on the 20th Jummadí-úl-úla, 1242, Híjrá, (or the 21st December, 1826,) the Jihád against the Káfir Sikhs began." The events of this war were watched with a natural interest by the Mahommedan population of India generally, whether followers of Syed Ahmed or not. Many of the inhabitants of our Western Provinces went in bodies to range themselves under the

\* This is a grievance of old standing among the Mahommedans of the Lahore territory. Malcolm, speaking of the period when our army under Lord Lake pursued Holkar into the Panjáb, in 1805, says, "The Mahommedan inhabitants of the Punjab used to flock to the British camp, where they said they enjoyed luxuries which no-man could appreciate, that had not suffered privation. They could pray aloud, and feast upon beef."

standard of the *Amír-ul Mominín*, or Leader of the Faithful, the title which he had now assumed to himself; and his emissaries gathered large contributions of money and jewels, even from our own distant Presidencies, and from the principal Mahommedan towns of the Dekhan. The prominent occurrences of the war, the perseverance with which it was kept up, the temporary and occasional successes which Syed Ahmed met with, and his ultimate death in battle, are well known. With his death, the struggle appears to have entirely ceased. That event, as was to be expected, is one which the people of his sect have been very reluctant to believe, and reports are still every now and then circulated among them, that he has been seen or heard of alive, and that the Sikhs are yet to have a rough waking from the dream, in which they are vainly indulging themselves, that they have got for ever rid of this inveterate antagonist.

But the notice of Syed Ahmed's personal fortunes has extended perhaps further than the subject merited. The account contained in the treatise, from which chiefly this paper has been compiled, of his rapid progress in spiritual illumination, deserves however to be adverted to, as affording a curious insight into the state of opinions among Mahommedans, on such subjects at the present day; and an abstract of it will be given, in referring to the portions of the work which relate more especially to speculative or Sûfî practices. The following string of questions, translated from a *risâleh* or tract, composed in refutation of Syed Ahmed's peculiar doctrines and pretensions, by an anonymous "*Fâzîlî Madrâsî*," or learned man of Madras, furnishes a convenient summary of the more important of them, and forms an appropriate introduction to the more lengthy statements of the *Sirât-ul Mûstaqîm*.

The questions are given with the short preface which precedes them in the original. "To the skilled in religion and law, these queries are submitted, in the hope that the perplexing doubts which have in this age seduced the more illiterate among the faithful into the thorny ways of error may by their sound explanations be removed, that right doctrine may be distinguished from deluding falsehood, and the actual relations and bearings of the truth, made clear to those now lost about and wandering in uncertainty."

*Queries 1, 2, and 3.* "Can any one properly lay claim to be the founder of a new and independent sect of law and morals, (to be a *Mujtahid-i-mûstuqill*) after the time of the four chief *Mujtahids*, (the heads of the four legal sects, the Hanâfî, Mâlikî, Shâfîî, and Hanbalî,) and before the appearance of the Imâm Mehdi? Has any

one ever advanced such a claim? And, shall a claim of the kind now be recognized on the part of any one, who in these degenerate times, because he has picked up more or less knowledge of the ordinary books of commentaries and traditions, shall choose to set up a sect of his own, differing in a minute point or two from the four established ones? Is it too permitted to an uninformed person of any of those sects, to act on a tradition not recognized by his own sect, or by any of the sects?' (These three questions have reference to one of Syed Ahmed's opinions, which is asserted distinctly in the *Sirát-ul Mústaqim*, that it is improper to follow the authority of the four *Mújtahids*, or *Imáms*, where an opposing tradition\* of the Prophet's precepts, or example, may be found of proved authenticity, and not subsequently rescinded. The established opinion is, that the mere fact of a tradition not having been received by one or other of the *Imáms*, shews it to be not authentic.)

*Queries 4 and 5.* "Is it proper to found a new sect, and school, (of *Súfí*, or enthusiastic devotion is meant,) and to give it the name of the Prophet of God, in the sense in which the appellation of "*Múhammedia*" has been given to the school of Syed Ahmed? and is it competent to any person not skilled in all branches of knowledge, external and spiritual, to claim to be a "*Mujaddid*," or Renovator of Religion? (This last claim was advanced by Syed Ahmed on the ground of a generally received tradition to the effect, that after every hundred years, God will send forth a person to renovate the faith. The objection to the term "*Muhammedia*," as it was used by Syed Ahmed, is, that it implied an almost exclusive claim to connection with the Prophet. Had "*Múhammad*" formed a part of his own name, it might have been employed by him without impropriety, to denote the connection of the school, or sect, with himself personally.)

*Queries 6 and 7.* "Is it lawful for a person to assume the title of "*Amir-ul Mominin*," or Leader of the Faithful, who holds no sovereignty, and cannot enforce his own orders? And what is the true meaning and application of the tradition which says, that he who does not recognize the *Imám* of his age, dies the death of ignorance, (that is, similar to that of the Arabs, in what was called their state of ignorance, or before the time of Mahommed); and is it absolutely binding on men to establish an *Imám*, or conditional only on their power to sup-

\* Such traditions, which, after the *Qoran*, are the standard authorities on all questions of Mahommedan Religion or Law, are intended wherever the word is used here.



port him, and on the absence of opposing circumstances?" (These questions need no explanation, though the remark obviously occurs, that they suggest very convenient excuses for declining to give support to the enterprise of a mere fanatic adventurer.)

*Queries 8 and 9.* "Is it a violation of the Unity\* of the Godhead to add to the true believer's profession of faith, "There is no God but God," the further declaration that "Mahommed is the prophet of God."

Is this giving a companion to God, or is it the very essence of the true faith? And is it unlawful to invoke the Prophet by the words, "Ya Rasúl Alla," or "Oh! Prophet of God." (These relate to branches of the Syed Ahmedí doctrine, of avoiding every thing which may bear the appearance of a departure from a pure belief in the Unity of God. It seems however questionable, whether the opinion implied in the first query is fairly imputed to the sect. Regarding the subject of the last question, the writer of the tract maintains, that to invoke the Prophet as an intercessor only is perfectly allowable. The point is not minutely dwelt upon in the *Sirát-ul-Mústaqím*, but in another printed treatise, by the same author, in the Hindustání dialect, named the "*Taqwíat-ul-Imám*," the opinion animadverted upon is supported by a little refinement in argument. There is, it is admitted, nothing heretical in supposing, that departed Prophets and Saints may be able to *intercede*, but the faculty of hearing at the distance at which they are now removed from this nether world belongs to God alone.)

*Queries 10 and 11.* "Is it not lawful to make pilgrimage to the tombs of Prophets and Saints (*Ambiá wa Auliá*), or of Mahomedans generally, repeating on such occasions texts and prayers from the Qoran, and avoiding what are notoriously abusive innovations? "And is the practice of performing the ceremony of the *Fatiha* in honor of the Prophet, of his companions, (the *Sahába*), of Saints, or of any Mahomedan without distinction, by reading, at stated periods and anniversaries, sentences of the Qoran, and then conferring the blessing annexed to them, and to the food distributed at such times, on those exalted spirits—an innovation to be received as acceptable and praiseworthy, or is it to be rejected?"

(The practices here referred to are among the most obviously prominent of those in which the members of Syed Ahmed's sect have

\* It is not easy to find any single English word which shall convey the meaning of "Isbrak" (إِسْبْرَاق), or the giving or attributing a companion to God. It has been rendered, as here, a violation of the Divine Unity throughout this paper.

departed from the general and deep-rooted usages of their Mahomedan brethren in India. Occasionally their pious zeal impels them to remove altogether such dangerous temptations to what they consider a violation of the Unity of the Godhead, as the tombs of Saints, by forcibly pulling them down. The word *Fatiha*, which denotes originally the first chapter of the *Qoran*, is commonly used to signify the whole ceremonies performed and prayers offered in behalf or in honour of the deceased, on the anniversary of their death or other fixed periods. Such ceremonies are observed in honour of relations or of any venerated Saint, and as practised by the vulgar, they go much beyond the simple form described in the queries. At celebrated shrines, they are kept up with great pomp and solemnity ; and what are mentioned in the queries as offerings, distributed for the benefit of the spirits of the Saints, are in reality ordinarily regarded as propitiations presented to secure their favour and protection. Saints are in effect commonly made direct objects of worship. Against the customary abuses of this ceremony, therefore, Syed Ahmed's instructions and denunciations were peculiarly directed ; long arguments, exposing their impious tendency and character, are contained in the *Sirát-ul-Mústaqim*, and they are a leading object of invective in all the writings of the sect. A good account of the ceremonies at shrines, with a notice of several of the most venerated Indian Saints, is to be found in the numbers of the *Asiatic Journal* for December, 1831, and January and February 1832, abridged from an article in the *Journal Asiatique*, on the peculiarities of Mahomedanism in India, by M. Garcin de Tassy.

*Queries 12 and 13.* "Is it unlawful, or unattended with reward or benefit, to repeat prayers sanctioned by the example of Mahomed (*Súnnun*), whether of fixed forms or numbers, or occasional and supererogatory prayers, when unobjectionable seasons are chosen for them ? And is any one privileged to prohibit the giving of blessings to Mahomed, (that is, the expression by men, of blessings upon him,) or repeating from books in which such blessings are set forth ? (It appears from the answers to these queries, that Syed Ahmed denied that there was any excellence or virtue in the practices adverted to.)

*Queries 14 to 18.* "Have the leaders in the path of religious contemplation held it admissible to receive men indiscriminately as disciples into several of the *Súfí* schools at the same time, or to receive as a disciple one who has already adopted a religious instructor or guide, of a virtuous and pious character ; such instructor being living and present, and not having given his consent ? And is it not prohibited that any one, for his own corrupt and interested purposes, and

not possessing the requisite purity of heart and spirit, should deceive the vulgar with false stories of his soul having ascended into the heavens, and conversed with angels and the souls of the Prophets? Is not the using frauds in religion, and the turning the heads of the vulgar from the fixed and certain way, a thing of fatal consequence, and an obstruction to union with the Deity, (the mystical union with the divine Spirit is meant?) And is it proper or possible for any one justly to claim such an union with the Deity, who has abandoned the established rules and methods of the *Ahl-i-Shariyat wa Tariqat*, the teachers both of the external institutes of religion, and of the more refined and contemplative devotion?" (These concluding queries refer exclusively to Syed Ahmed's pretensions to eminent success as a religious enthusiast and devotee, and sufficiently explain themselves.)

5. The *Sirátul Mustaqim*, which was composed before its hero, (as he may fairly enough be termed,) had proceeded with its author on pilgrimage to Mecca, and was printed in Calcutta during their absence at Mecca, by an active member of the sect, Moulavi Mohammed Ali of Rámpúr, discloses little or nothing of the designs which the party entertained of stirring up a war of religious fanaticism against the numerous infidels of India, though it breathes, in treating of the duty of religious war, a sigh of pious regret over the darkness which has in these later days overspread the land. Compare, it says, the state of Hindústán with that of Rúm and Túrán! Compare it even with its own condition two or three hundred years ago. Alas! where are now the *Ouláa* and *Ulama* of those times? But the subject is only incidentally touched upon, and the part of the treatise which relates to external duties of piety and morality includes it in a very general review of those duties in all their branches. This review is contained in the second chapter of the treatise, where it is inserted to shew the preparation necessary before any real benefit can be gained by entering on the exercises of religious contemplation. The chapter is thus entitled, "On the avoiding innovations in religion, and the mode of performing acts of religious duty and worship; on the purifying of the heart from vices, and adorning it with virtues." In much of this chapter, there is nothing peculiar beyond the degree of extreme purity and fervent zeal, which is insisted upon as indispensable for an aspiring devotee, though it is expressly stated as being in excess of what is required for acceptance as a true Mahomedan. The denunciations against innovations are all that it is interesting to notice; and these, illustrated by more detailed explanations of the generally prevalent abuses

from other treatises, fully mark the puritan system of doctrines, which wherever it has been embraced, pointedly distinguishes the followers of Syed Ahmed from the bulk of the Mahommedan population. Scattered in comparatively small bodies, over numerous parts of the country, these people will probably be found to present everywhere nearly a uniform character, modified only by such broad traits of differences as exist between the natives of Bengal and those of Upper India. Mahommedanism, as it came pure from the lips, or was exemplified in the life, of the Prophet, was the aim and profession of the founder of the sect. Its members consider themselves the only true Mahommedans, and regard the faith and practices of their countrymen as little in advance of the idolatry of their Hindú neighbours. They guard themselves as separate communities, apart from the contagion of the ordinary superstitions; they refuse to join their nearest relatives in their most solemn and cherished ceremonies; they are arrogant, intolerant, ready to give offence by proclaiming their contempt for the commonly received opinions and prejudices, often, where they are strong enough, by open acts of turbulence and violence. Wherever they exist, more or less of irritation may be expected to arise between them and their brethren from whom they have separated; but being commonly very much the inferior party in numbers, they are likely to be kept down, or to get only noted and laughed at for their excessive and precise zeal, and the ignorant conceit, (the remark applies to the condition of the ordinary peasantry of the country,) which accompanies their pretensions as the professors of a reformed belief and worship. They will, at the same time, probably, deserve the credit of being strict and sincere in the performance of the prescribed exercises of their religion, and of having improved in many points of moral character, in consequence of their change of doctrine. All these circumstances, and the nature of the doctrines themselves, seem sufficiently to shew, that the sect is not calculated to be permanently popular, or to spread very generally and rapidly, unless under the impetus of some strong causes of excitement, of the occurrence of which there is now but little probability.

The innovations to be carefully shunned by every true Mahommedan are divided in the treatise under three classes. The first, those which have sprung from association with sceptics or heretics, and with those who sin against the Unity, and give companions to God, appearing like genuine Sufís\*. The second, those which have been

(ملحدین و مشرکین صوفی شعار متشیبهہ بصوفیہ کبار)۔

caused by association with Shíás. The third, such as have had their origin in the imitation of bad and corrupt usages generally.

Among the abuses included within the first of these classes are the following. Excess of respect to Murshids, or religious instructors. The numerous innovating ceremonies, which have become generally observed at tombs; and the making offerings in honour of saints: abuses, which may be said to constitute, in practice, nearly the whole religion of the common Mahommedans of the country. These have almost universally their Murshids, to whom they pay implicit deference. To their venerated saints they apply in every difficulty, undertaking long and expensive pilgrimages to their shrines, and propitiating them by offerings and vows, to lend their aid in the attainment of every object of earthly desire—children, health, fortune, or honour. These innovations however may more accurately be ascribed to familiarity with the rites and customs of Hindúism, than to the influence of any Súfí speculations. The resemblance between a Mahommedan Murshid and a Hindú Gúru, is obvious. In India (to adopt the phrase of the “*Hidáyatul Mominín*,” also a Syed Ahmedí treatise.) more than in any other Mahommedan country, Islám and Káfr have been mixed like *kichrî*! “If the Hindús have their Gyah, their Mathura, and their Káshi, the Mahommedans have their Makwánpur, (where the tomb of the saint Madár is,) their Baraich, (where the holy Salár, or Salár Masúd Ghazí is buried,) and their Ajmír, (where the attraction is the well known tomb of Khwájá Moyin-ud-dín Chishtí.) The one set build mat’hs over their idols: the other, not to be behindhand, raise domes over their saints’ tombs. In the mat’hs, you will find Mahants and Gosains: at Mahommedan shrines, Khádims, Mujáwirs, and Pírzádas:”—the latter being a numerous and influential race, whose interests, fortunately perhaps, are directly opposed to the spread of the doctrines of these strict and sweeping sectaries.

The rule laid down in the *Sirátul Mustaqím*, respecting the reverence due to a religious instructor and guide, is, that it is quite proper to adopt such a person, and requisite indeed to those who desire to tread the path and obtain the rewards of contemplative devotion. But that he should not be so honoured as to be obeyed in preference to the orders of the *Qorán* and the Prophet. In indifferent things, his authority should be held paramount. “Follow no one,” says the *Taqwíatul Imán*, “be he Mújtahid, Imám, Ghaus, Kutb;” (these two are appellations given to personages supposed to possess a certain high degree of spiritual power); “Moulav, Mushá, King, Minister,

Padri, or Pandit, against the authority of the Qoran and the Traditions." These opinions are evidently connected with the pretensions which Syed Ahmed has been mentioned to have advanced of disregarding the authority of the four Mújtahids, whenever opposed to a tradition which might appear to be authentic, and never to have been rescinded.

Respecting the abuses prevalent in regard to the tombs of saints, and the offerings and honours paid to them, the Sirátul Mustaqím declares them to be endless—but selects a few for prominent reprehension. The subjoined is a concise abstract of the diffuse arguments and illustrations into which it enters on the subject. "First," it says, "the vulgar think it more of a sacred duty to make long and difficult pilgrimages from all quarters to the shrines of Saints, than to perform the pilgrimage to Mecca, though the end of all the trouble they impose on themselves, may be to run them into heresy and impiety, and by consequence to God's wrath. The performance of such pilgrimages may certainly yield a little benefit to the spiritual devotee, but it causes such excessive injury to Mahomedans in general, that all ought entirely to abandon it. Secondly; The asking favour and assistance from the Saints of the shrines, with a belief in their independent power, which is open blasphemy. Thirdly; The burning of lamps on tombs, which is actually believed to have the virtue of rendering prayers acceptable, though the practice is strictly prohibited in traditions of unquestionable authority; and all who are careful to choose that as the period for offering their prayers, if they have not ignorance for their excuse, are clearly Káfirs. As to the offerings made on behalf of Saints, as at the ceremony of Fátíha, their origin was good, and according to the law; but the grossest abuses have crept in upon them, varying from the lowest, which is, imposing on oneself as absolutely obligatory what is really not so, to the greatest, which is openly to sin against God's Unity. The devotions of the living doubtless confer benefits on the dead, but this may be done in two ways: One, by leading a life of general piety and goodness, by which alone the duty which men owe to God, the Prophet, their religious instructors, (all in the religious family, to the Saint, its first founder, are understood to be included,) and their natural parents will be fully fulfilled; and therefore a pious man may abandon the performance of Fátíhas altogether. The other, by doing some specific virtuous act for the benefit of the departed. The ceremony of Fátíha belongs to this latter class, and if performed with the sincere desire and ~~assisted~~ assisted by prayer or not, that the reward of the

gifts distributed, may be conferred on the deceased, it is blameless; but then there must be no restriction as to times of distribution, kinds of food, modes of serving it, or the descriptions of persons who are to be privileged to share in it"—a condition, which at once strikes at the root of all that is thought most valuable in the usual practices of the Fātiha, and separates completely Syed Ahmed's followers from the ordinary community. It will be seen, how the doctrine tends to break up families, when one who has adopted it would refuse to join his brother in the ceremonies thought most binding in commemoration of their father's death. A variety of objections are urged against the propriety of the restrictions which are to be so entirely rejected. The sum and climax of all is, that the observance of them, replete with abuse as they are, has come to be considered as alone constituting the real essence of faith; that it is not *for* Saints, but *to* them that the offerings are regarded as being made; and that saints are therefore in reality worshipped, while God is neglected or forgotten.

Besides the going in pilgrimages to distant tombs, and observing the common ceremonies of the Fātiha, there are a variety of superstitious practices connected with those usages, and with the veneration paid to Saints generally, each of which is separately detailed, and its relinquishment *insisted upon* in the Taqwīatul Imān. The modes in which a pure belief in the Unity of God is departed from, are there classed under the four divisions of "Ischrāk fil Ilm, Ischrāk fil Tasarraḥ, Ischrāk fil Ibādat, Ischrāk fil Adat," or the assigning to God an associate or sharer in his Omniscience, in his exercise of the functions of Omnipotence, in the worship rendered to him, or the reverence shewn to him in any of those acts, among the practices of common life, which are indicative in any degree of sentiments of adoration or awe towards a superhuman power. Among the most popular practices springing from reverence for saints, which are denounced as belonging to one or other of those classes, are the applying to them for any particular desired blessing, as for children, &c. in the supposition, that their favour can, in a manner, reverse the order of fate—the dedicating in vows, and setting apart, animals to be sacrificed as offerings to them, or in honour of them, and the placing distinguishing marks upon animals for that purpose, which is declared to be an impiety, though even the orders of the law should be complied with by the "B'ism Illah" being repeated when the animal is actually killed—the making offerings of gratitude or propitiation to Saints after the birth of children—the giving to children names implying that they have been obtained through their favour; such as "Nabī Baksh," "J'nām Bē' 'ī," "Madār Baksh,"

“Abdul Nabí,” “Bandā Ali,” &c.—the allowing particular locks, or patches of the hair of children to grow untouched for certain periods, or the boring their noses or ears, as a mark of devotion to, or reliance for protection on, a Saint—generally the shewing the same signs of respect to Saints, as by standing up in repeating their names or invoking them, as to God himself—the making Sijda, or entire prostration to any one but God—and the making the “Tawwáf,” i. e. a circuit or number of circuits, round the tombs of Saints, a ceremony to be performed round the holy Káába only.

The doctrine laid down in the Taqwíatul Imán, the authority or influence of Saints, as respecting intercessors is, that they may undoubtedly be privileged to intercede, but only when God has first granted them permission; and that the proper course is not to depend at all on their assistance, or to make any special prayer for their intercession, but to leave that, with all the other desires or necessities of man, to God alone, who, should such be requisite, will be careful both to provide an intercessor, and to give a sanction to his requests.

Of the second class of prevalent abuses, or those which have sprung from association with Shíyas, the first is an alleged departure from the established and orthodox belief respecting the relative superiority and precedence of the four first Caliphs, Ali being by many considered as possessing a higher degree of dignity and honour than his predecessors. This error is said to have in part arisen from the circumstance that most of the families or schools of religious devotees trace their origin up to Ali. The second abuse of this class consists in the ceremonies of the Moharram, which are observed as solemnly by very many of the common Súnís of the country, as by Shíyas. “A true believer,” it is declared, “should regard the breaking a Tázia, by force, to be as virtuous an action as destroying idols. If he cannot break them himself, let him order others to do so. If this even be out of his power, let him at least detest and abhor them with his whole heart and soul.”

Of the abuses which have sprung from bad and corrupt customs generally, those first marked for reprobation are the showy or expensive ceremonies on occasions of festivity and mourning—at marriages, and after the death of relatives. It is thought better, our author indignantly exclaims, that children should starve at home, than that these extravagancies should be abandoned. From such customs, a true Mahommedan should as far as possible keep free. He should labour indeed zealously to put a stop to them, reverting in such things to the orders of the Prophet, and the practice of his companions. “Fol-



low the example of Mohammed of Arabia," is the concluding direction in this part of the treatise, "and relinquish all the usages of Hind and Sind, of Fars, or of Rûm;" a comprehensive exhortation which gives in a few words the whole spirit of the reforming doctrines.

Another abuse of this class, attributed to intercourse with Hindûs, is the prohibition of widows from a second marriage. "If there be a widow among your relations," (is the injunction on the subject,) "make her, if you can, marry a second time, whether she wishes it or not. Should she persist in refusing, relinquish all kindly intercourse with her—Shrink not, should you in this depart from the fixed customs of your ancestors; God has a higher claim upon you than they." It should be mentioned, however, that it is not known how far this injunction is at present respected, or at least practically acted upon, by the members of the sect generally.

Of the further abuses, referrible to this last division, there may also be mentioned, from either the *Sirâtul Mustaqim*, or the *Taqwîatul Imân*, the vain glorious relying on the good qualities of pious ancestors, which is noted as the special sin of Syeds and Pîrzâdas—the placing faith in the practices of astrology or sooth-saying in any shape, or in omens or Fâls from the *Qoran*—the attending to lucky or unlucky days—the worshipping, like the Hindûs, their goddess of the small-pox, *Sitalâ*, or even [a curious excess of enthusiasm] the adopting the infidel custom of keeping children from going near others who have the small-pox—the keeping pictures of the Prophet or of Pîrs—the swearing by any one but God—the using the words *Mâlik* and *Banda* to express the relation between master and slave—besides which are enumerated very many others, defying any concise enumeration, against each of which the *Taqwîatul Imân* arrays a battery of texts from the *Qoran* and traditions, made accessible to all readers by translations and comments in the plainest Hindûstani.

The above comprises as complete a sketch of the peculiar opinions of the sect of Syed Ahmed, in all matters of external worship and morals, as has been found immediately procurable from information and books to be obtained in Calcutta, and presents doubtless a sufficiently accurate outline of them. The effect which they must have in separating their professors as distinct communities will be obvious on the mere perusal of them—for they may be literally said to affect every important event in which men can be concerned from their cradle to their grave.

It is to be remarked, as a new feature in the history of efforts for the propagation of Mahommedanism, or for the reform of its corruptions, how extensively the emissaries of this sect have availed themselves of the press to disseminate their tenets. The *Sirátul Mustaqím*, the *Taqwíatul Imán*, the *Hidáyatul Mominín*, and a little tract attached to it, named the "*Múzihiul Kubair wa'l Bida'úl*," and two other tracts, entitled the "*Nasíhatul Muslimín*" and "*Tum-bíhiul Gháfílin\**," have all been printed at private presses in Calcutta or at Hooghly.

The pretensions of Syed Ahmed as a holy Súfí devotee, and his system of enthusiastic discipline and devotion, remain to be adverted to—but any thing beyond a very cursory notice of them would be tedious. A few words will explain all that appears to be peculiar in the system, and the details here given do not therefore extend beyond the account which has been stated to be contained in the *Sirátul Mustaqím*, of the rapid progress of this apt scholar in the paths of spiritual knowledge. With this branch of his opinions and instructions, it is to be supposed, that the great mass of his followers have but little, if any, minute acquaintance.

It has been mentioned, that the author utterly denounces the infidelities, which have attended the more refined and metaphysical speculations of numerous Súfí professors. This denunciation is to the following purport. "Among the greatest obstructions of the path to God are infidel or heretic pretenders to Súfíism (*Mulhidín i Súfí Shiár*), who so far from fearing to violate the commands of the law, make the doing so their habit and characteristic—who teach and learn detestable, innovating, impious exercises or practices—and propagate infidelity (*Ilhád*) in the world; Let such be dealt with according to their deeds. Let those who deserve death, be put to death; and let those who merit the other grades of punishment (*Tázirwa Tambih*) receive them. If it be not in your power to enforce the orders of the law, look on such persons with loathing, and regard the very sight of them as an abomination."—On the question of the identity of God and matter—an opinion very prevalent among Súfis—it is declared, that the point is one which it is worse than useless to be constantly discussing, but that what has been said respecting it by the illustrious authorities of Súfíism—the *Akábr i Taríqat*—does not go beyond

\* Since this paper went to Press, the writer has seen another Treatise printed in the course of last year, the *Midyatul Masá'il*, or the hundred questions: being answers by Shékh Mohammed Ishak, a grandson of Shah Abdúl Azíz, to queries stated to have been put to him by some of the Royal family at Delhi.

this, that created things are not to be considered as actually one with the Deity (*cyn i haqq*), though they have their stability and permanence in him, and are the *muzahir i sifât*, the media in which he has chosen to manifest his qualities.

The foundation of spiritual progress in the school of Syed Ahmed, as with Sufis generally, is an entire abstraction from personal or worldly reflections and interests, and an ardent and unceasing adoration of, and love for, the Deity. But it is held to be important to distinguish between two kinds of love, of which our nature is capable, and which are of separate characters, though, with a true saint, like Syed Ahmed, they may exist, and be cultivated in full vigour together; and the difference between these and the relative value of the two are stated to have been too much lost sight of, especially in these later days. The one designated *hubbi tshki*, has its origin in feeling and passion, in the longing of the soul to rejoin its divine source; the other, termed *hubbi imâni* or *hubbi aqli*, (to which an indirect preference is given,) springs from the intense admiration and affection, with which it is inherent in the constitution of man's reason and perceptions, that he should regard a Being possessing all the qualities of beneficence, power, and infinite perfection, which are combined in God. Of the former love, the aim and reward are a certain mystical absorption in or junction with the Deity, accompanied by the highest degrees of spiritual knowledge and dignity. Of the latter, the result is an entire devotion of thought and purpose to the service of God, which is recompensed by its possessor being employed as an inspired and prominent instrument for working the divine will, or promulgating the divine commands, in the world. The former is declared to have been the special state and ornament of the Oulia or saints, and the exercises by which it is to be perfected are therefore termed the *râhi wilâyat*; the latter was the peculiar attribute of the various Ambia, or prophets and messengers to man, and the modes of acquiring and strengthening it, to the degree to which it can now be carried, are termed the *râhi nabûwat*.

So much of introduction explanatory of the nature of these fanciful opinions has been necessary to render intelligible the following abstract of the history of Syed Ahmed's progress towards the perfection of the saintly character. It will seem strange, that such wild deductions should ever have received\* acceptance, which it must be sup-

\* It is not known, that the *Sirâtul Mûstaqim*, though printed, has any extensive circulation. The pretensions which it puts forward for Syed Ahmed, are however, the same as those which he actually advanced for himself, and on which

posed that they in some degree did from the reputation which this fanatic generally acquired. The aim of the whole to serve his object of establishing a claim to a high mission, and attracting followers, is very obvious; but the familiarity with which his alleged intercourse with the Deity is spoken of would, to our notions, indicate rather a near approach to irreverence than the excess of devotional awe, which is inculcated throughout this treatise. The names which occur of the three Sûfî schools, the Kadirîa, the Chishtîa, and Nakshbandîa, have been already explained.

“Let it be known,” says Mohammed Ismael, “that all the perfections of the *Tariq inabûwat* were implanted from his birth in the nature of this holy man, as evidenced by the delight which he took in the exercises of piety, and practice of virtue from his childhood. At length, when he was admitted into the society of the venerated Shèkh Abdul Aziz, (who received him as a disciple into the Nakshbandîa school,) by the propitious effects and influence\* of the enlightened spirit of his instructor, the concealed excellencies of his nature developed themselves in a rapid succession of wonders. Of these, the first was that he saw the Prophet himself in a dream, who fed him with three dates in succession, which circumstance he knew to be true by the effect which he found to be remaining (on his palate, it is to be supposed) when he awoke. This was the commencement of his progress in the *Tariq inabûwat*. A further eminent advance in it was gained by him from the following event: In another dream, he saw the sainted Ali and the holy daughter of the Prophet, Fâtima—when the former bathed him with his own sacred hands, and washed him carefully, as parents wash their children, and the latter clothed him in garments of exceeding richness. On this the favour and acceptance, which had been set apart for him from eternity, became directly visible, and he was taken under the

he founded his claim as the head of a new school and sect. The genealogical tree of his religious family, a copy of which, like other religious teachers, he consigned to each of his disciples, contains statements of his communications with the Deity and with the spirits of saints, similar to those of the passage here translated. It gives also the names of the different Pîrs of each religious stock in which he professed initiation, up to their respective founders: his claims being thus of two kinds, one of direct communication from the spirits of the several saints, the other of initiation in the ordinary mode.

\* The words are “*Barokat i tawajjuhât.*” “*Tawajjuh*” is used in the passage in a technical Sûfî meaning, implying the devotion by a teacher of all the contemplative powers of his mind to the object of communicating his own illuminations to his disciple, which is supposed that he has the faculty of doing.

immediate guidance and guardianship of God. One wonder followed upon another, till one day the Deity taking his right-hand with his own arm of power, and placing before him some of the rare treasures of heaven, said to him, 'This I have given to you, and I shall give you yet more.' About this time, some one entreated urgently to be received by him as a religious disciple; when he put off giving a final answer for a few days, and in the interim, applied with the eye of contemplation to God, saying, 'You have taken my hand, which whoever in this world does\*, attends always to the obligation thereby assumed, and what relation can the virtues of mortals bear to the qualities of God? What course then is it your will that I should follow towards this man who desires to adopt me as his religious guide?' The reply from God to this application was, 'Should thousands and thousands seek to be your followers, I shall provide for (or be sufficient to) them all.' And in this way event crowded on event with him, and fresh miracle upon miracle, till he reached the ultimate perfection of the *Tariq i nabúwat*, and attained to inspired knowledge.

Next as to the *Tariq i wiláyat*—respecting this it is to be understood, that the modes of exercise and contemplation followed in each of the separate schools lead to a certain peculiar capacity of connection in the spirit of the devotee with the Deity, which ordinarily is not acquired till after all those preparations have been gone through. But occasionally with some higher or more favoured spirits, this capacity precedes any use of preparatory discipline. So it was with Syed Ahmed. In the *Kádiria* and *Nakshbandia* schools, it was gained in a few hours, and directly from communication by the spirits of the founders of those schools—they having contended for nearly a month with each other for the exclusive possession of him, and having in the end agreed to descend upon him together. In the *Chishtia* school, its acquisition was commenced by communication from the spirit of the revered *Kútbul aktáb Khwaja† Bakhtiár Kákí*, when Syed Ahmed was sitting in contemplation on the tomb of that saint, and it was afterwards perfected by communication from God himself. This happened to him in the *Akberábádi Masjid* at Delhi, when he was engaged in devout contemplation with a number of his followers, among whom the writer,

\* The form is that by which a Murshid, or religious guide, receives the adherence of his followers.

† He was a celebrated Saint of the school.

Mohammed Ismael, himself was. When the assembly had broken up, he told the writer what had occurred in the course of it, viz. that Gol had himself vouchsafed directly to complete what had remained imperfect in his knowledge in the Chishtia school. From that time he began giving instructions in that school also, and introduced of himself the new and more expeditious method of performing its exercises, which has been described in this treatise."

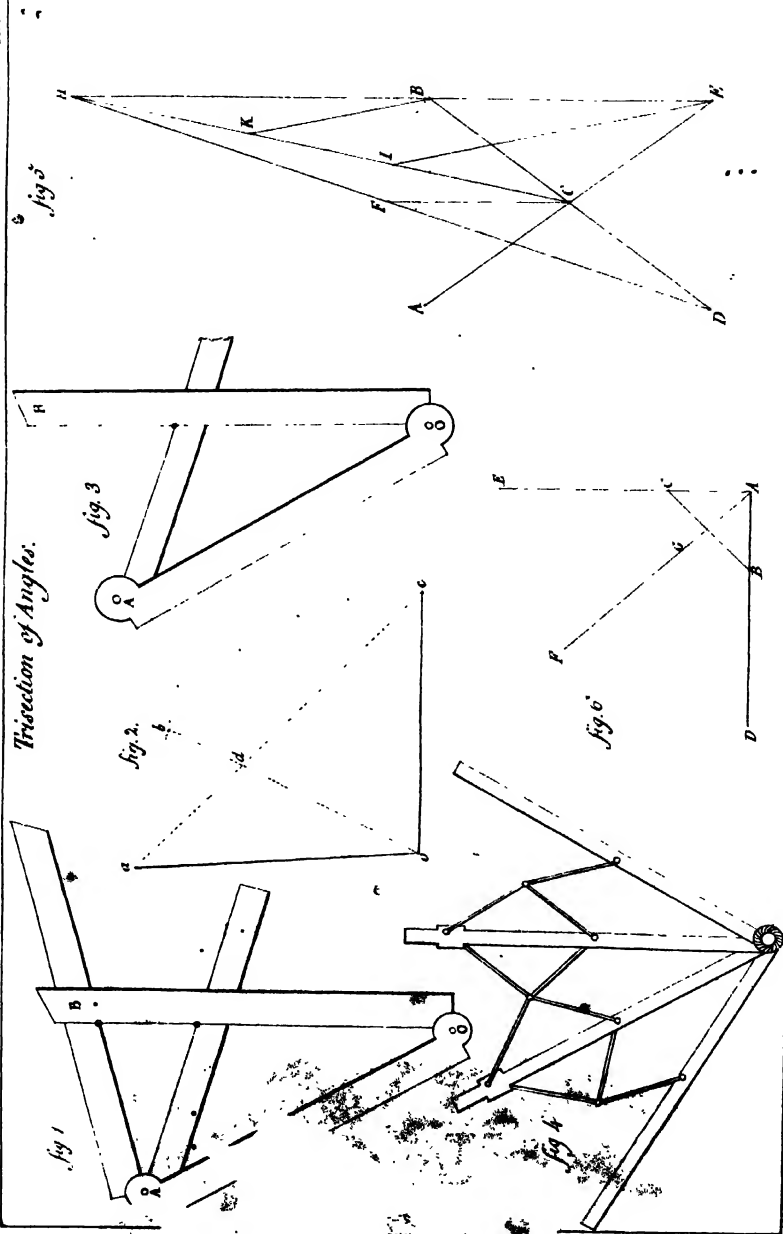
The above is a sufficient specimen of the extravagances of enthusiasm or imposture which pervade the book. What is claimed as the peculiarity of the system which it explains, consisting of the distinction drawn between the two kinds of love towards the Deity, by which a devotee may be actuated, and of the grades of spiritual distinction to which they severally lead, much of it is occupied by expositions and illustrations of the grounds on which that distinction rests. These form the subject of the first chapter. The second chapter treats of the religious and moral duties and observances, the exercise of which prepares the devotee for spiritual contemplation. The third relates to the modes of contemplation prescribed by Syed Ahmed, for attaining to the perfections of the *Tariq i wilayat*, with reference to the peculiarities of each of the several prevalent schools, and contains much which might be thought curious, could its technical details be brought within any short compass. The fourth describes the process of acquiring the excellencies of the *Tariq i nabúwat*, and a *Khátim* or conclusion sets forth the wonders experienced by Syed Ahmed himself, in the passage which has just been translated.

It has only to be added, that the treatise professes to have been written throughout, though not under the dictation, yet under the immediate eye and revision of Syed Ahmed. He, it is stated, having been endowed with a nature resembling in all respects that of the Prophet himself, was unacquainted with the forms and technicalities of worldly science. So that, to render the subject intelligible to general readers, his sayings and lessons have not been given exactly as he uttered them, but have been explained and arranged by the author according to the ordinarily understood rules of composition. The whole however was carefully read over to, and corrected by, him before being given to the world.

J. R. C.



*Trisection of Angles.*





II.—*Description of an Instrument for trisecting Angles.*    By  
*Lieut. T. S. Burt, Engineers.*

I have the pleasure of sending you, for insertion in the *Asiatic Journal*, a description of an instrument I have lately made for trisecting any plane angle, which I should not probably have been induced to trouble you with, had I not seen, in the *United Service Journal*, for January last, an account of Captain Burton's problems for effecting the trisection, but they are all, you will have perceived, founded on trials, which in these cases are not allowed: and also, in the same volume, Major Mitchell's problem; but his attempt is very easily disproved, notwithstanding the confidence with which he gives it forth, as the true mode of trisecting an acute angle, which it is well known cannot be effected geometrically, and which, moreover, has been proved to be impossible.

*Description.* The accompanying Plate XII. fig. 1, exhibits a sketch of the instrument or trisector, which consists of four pieces of brass connected together at, but moveable on the points A and O. The leg or piece, A B, passing through a groove or opening at the extremity of the leg O B, in order that it may allow of O B being slid at B, over and along its length. The piece A D is made rather thinner than the others to admit of its passing underneath O B, whenever O B is made to slide along the leg A B towards A, as above noticed. A D is moveable on the point A.

This instrument will trisect any angle from  $1^{\circ}$  to  $180^{\circ}$ , and the correctness of its principle is evident from the annexed diagram, (fig. 2.) It may not seem irrelevant to remark, that No. 22, volume I. of the *Mechanic's Magazine*, contains the description of an instrument for performing a similar operation, invented in the year 1824; but that machine contains, of necessity, no less than 11 pieces, (see note at the end of this statement,) and its principle of construction is quite different from that of this instrument, which, as above stated, consists of only four pieces, and may, as I shall hereafter shew, be reduced to three.

*Application.* Let  $a o c$ , fig. 2, be any angle required to be trisected. Draw the chord  $a c$ , and lay the leg of the trisector, A O, upon one side  $a o$  of the angle, so that the point A of the instrument may coincide with the point  $a$  of the given angle, and O with  $o$ , respectively. Next, place the leg A D, which, as before described, is moveable on the point A, along the chord  $a c$ , without paying any regard to the length of this chord, until the leg and the chord coincide. Then slide the leg

O B, which is also moveable on the point O, until A D becomes equal to A B; this can be easily effected, (because A D & A B have each a scale of equal parts (of degrees) attached to them, commencing from A) The given angle  $a o c$  is now trisected, and A O B is the third part of it.

*Proof.* The two triangles  $a o b$ ,  $a b d$ , are equiangular, for the angle  $a b d$  is common to both triangles, as well as equal, both to the angle  $b a o$ , (because  $rad. b o = rad. a o$ .) and to the angle  $b d a$ , (because  $a b = a d$ , by construction or application of the instrument.) The two triangles, having 2 angles in the one, equal to two angles in the other, have therefore their third angles equal, namely, the angle  $a o b = \text{angle } b a d$ . But the angle  $b a d$ , at the circumference of the circle  $a b c$ , being measured by half the arc it stands upon,  $b c$ , is half of the angle  $b o c$ , at the centre of the same circle, measured by the whole arc  $b c$ ; therefore, the angle  $a o b$ , its equal, is half of the same angle  $b o c$ , or one-third of the whole angle  $a o c$ , which was to be trisected.

The legs of the instrument may be reduced, in number, to three, thus—The piece A B is absolutely necessary to the first construction, in order to affix a scale of equal parts to A D, similar to that upon A B, (one of degrees is the best, because the angle can then be read off, not forgetting, in dividing it, that A D is to be considered the *chord* of an arc; but as soon as the parallels have been cut upon both legs, A B becomes superfluous.

To show this, I will state how A D is divided;—1st, set off upon A B a scale of equal parts, making their productions pass through the centre O, at whatever position of the instrument, but governed by O B. 2dly, when these have been cut upon the leg A B, set off an equal scale upon the other leg A D, and make their productions pass through the corresponding lines upon A B, conveying to the centre O likewise.

This being done, it must be evident, that the subsequent use of A B is superfluous, because the leg O B, after it has been placed parallel to, that is, immediately over and upon, any line that has been cut upon A D, and that was made by construction, to pass through corresponding parallels on the leg A B, no longer requires, for this very reason, the aid of the latter piece; so that the trisector, in this state, will, as before mentioned, consist of only three pieces, (as shewn in fig. 3.) But, in this case, having applied A O and A D, as before, to the side and chord of the angle to be trisected, O B must be moved towards A, until Q B become parallel to, or coincide with one of these

lines of equal parts, which are cut upon the piece  $A D$ , and then the given angle will be trisected.

*Note.*—Fig. 4 is a sketch of the instrument above alluded to : it is copied from the 1st volume of the *Mechanic's Magazine*.

### III—On the Trisection of Angles. By Mr. W. Masters, *Verculam Academy*.

In one of the late numbers of the *United Service Journal*, there is an article on the trisection of an angle, written by a Major in the British Army, resident at New South Wales. This gentleman believes he has solved the problem, and demonstrated his solution, which is in substance as follows :

Let  $A B C$  be the angle to be trisected ; from  $C$  as a centre, and with any radius  $C B$  describe a circle ; produce  $A C, B C$ , to  $E$  and  $D$  ; join  $E B$  ; trisect the arc  $A B$  in  $F$  ; join  $C F$  and  $D F$ , and produce the line  $D F$ , till it meets the line  $E B$  produced in  $H$  ; join  $C H$  ;  $C H$  cuts the arc  $A B$  in  $I$  ; the arc  $B I$  is one-third of the arc  $A B$  : this is his solution of the problem. In the demonstration, he proceeds to say, take  $B K = B C$ , and from the centre  $K$ , with the radius  $K B$ , describe a circle, &c. &c. The demonstration appears to be complete, and the gentleman exults at his success ; but it escapes his sagacity, that his demonstration is built upon the hypothesis, that the circle  $K$  passes through the point  $H$ . Now, this is a very important point ; the whole solution depends upon it : it is obtained by the intersection of the lines  $E B$  and  $D F$  produced. My object is to prove, that the *locus* of the point of intersection, of the two lines  $E B$  and  $D F$ , is not the circumference of a circle, which passes through  $B$ , and whose radius  $B K$  is equal to  $B C$ .

If possible, let the point  $H$  be in the circumference of the circle  $K$ , described as stated above.

$$\therefore B K = K H = B C = C D.$$

$$\therefore B K + K H = B C + C D = B D ; \text{ but}$$

$$B K + K H > B H \therefore B D > B H. \text{ Again}$$

$$\angle E B D = B H D + B D H \text{ and}$$

$$E B D = B C F, \text{ because } E H \parallel C F,$$

$$\therefore B C F = B H D + B D H ; \text{ but}$$

$$B C F = \surd B D F \therefore B D H = B H D$$

$\therefore B D = B H$ , and it has been proved to be greater, which is absurd. Therefore the point of intersection of  $E B$  and  $D F$  is not in the circumference of the circle  $K$ , and therefore, a line,  $H C$ , drawn from this point to the centre  $C$ , does not cut off a third part  $B I$  of the arc  $A B$ ; because

If  $B I$  be a third part of the arc  $A B$ , the locus of the intersection of  $C I$  with  $E B$  is the circumference of a circle passing through  $B$ , whose radius  $B K$  is equal to  $B C$ .

Let  $B C I$  be the one-third of  $B C A$ , and let  $C I$  and  $E B$  produced meet any where in  $H$ ; (it is easy to prove, that they will meet in that direction :) join  $E I$ , and through  $B$  draw  $B K \parallel$  to  $E I$ .

$$\angle C K B = C I E = C E I = \frac{1}{2} A C I = I C B \therefore B C = B K.$$

Again  $\angle C K B = K C B = 2 I E B = 2 K B H$ ; but

$\angle C K B = K B H + K H B \therefore K B H = K H B \therefore K H = K B$ , and  $\therefore K$  is the centre of a circle passing through  $H$  and  $B$ , and having its radius  $B K =$  to  $B C$ .

The Major, therefore, has not trisected the angle : I believe, the problem remains just as it was before the Major took it in hand.

I hope I may be allowed to correct an error, relating to the present subject, into which many fall, who have not leisure to *examine* geometrical theories, &c., but yet have occasion to employ them. To trisect an angle, they are directed by some treatises, (Adam's Geometrical Essays, I believe, is one,) to find an arc that is equal to the third part of the given arc, and to *lay it off* on the given arc; and a cumbersome mode is taught of finding this required arc, which is easily obtained thus :

Let  $D A F$  be the given angle; take  $A D =$  any length  $= 3$  (for instance); and take  $A B = \frac{1}{3} A D = 1$ , and describe the circles  $D F E$ ,  $B G C$ ; then according to Newton's 5th lemma,  $A B : A D :: \text{arc } B G : \text{arc } B F \therefore \text{arc } B G = \frac{1}{3} \text{arc } D F$ . Now the difficulty is to *lay off* the *arc*  $B G$  upon the *arc*  $D F$ , so as to divide  $D F$  into three equal arcs. Recourse is had to a pair of compasses; but it is very plain, that the compasses measure only the *chord* of  $B G$ , which is a *straight line*, and not the *arc* itself, which is a *curve*. Let the right angle  $D A E$  be trisected after this manner, and it will be found, that the chord  $B C$  will not answer the purpose. If it do, each portion of the arc being equal to  $30^\circ$ ,  $B C = \sqrt{2} = 1.41$ , &c. will be the chord of  $30^\circ$ ; whereas the chord of  $30^\circ$  to the radius 3 is equal to 1.55, &c.

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V.—*Note on Indian Saline Deposits.* By Mr. Henry Harpur Spry,  
Bengal Medical Service.

[Read 3rd October.]

In the fourth number of the *Journal of the Asiatic Society*, a note was published by the Rev. R. Everest on Indian saline deposits, in which particular attention was directed by that gentleman to the large quantities of *carbonate* of soda found in a plain about 3 mile to the west of Ghazípur. He states also, that “As the *sulphaté* of soda, is said to be collected in large quantities, from the soil of the basaltic districts on the western side of India, it is not improbable, that these saline deposits are distributed over the peninsula of India co-extensively with the nodules of *kankar* (carbonate of lime), and hydrated iron ore.”

I have never met with any saline deposits among the trap formations of this district; but I am induced to believe the following notice regarding the sulphate of soda deposit in the Gangetic portion of the Oude territory, contiguous to Cawnpore, may not be unacceptable.

This saline deposit abounds in very large quantities about Unaú, and is found in the ravines all the way on to Sultanpur. It has a light earthy, and sometimes a dirty white, appearance in the mass, and its fracture is brittle. It yields by the common native process full 50 per cent. of pure Glauber's salt, of which quantities are annually manufactured by them; and on analysis I found 200 parts to contain of

|                               |       |
|-------------------------------|-------|
| Dried Sulphate of soda, ..... | 145.9 |
| Muriate of soda, .....        | 6.0   |
| Alumina, .....                | 25.0  |
| Trace of iron, .....          | 1.5   |
| Silicious sand, .....         | 9.0   |
| Trace of lime, .....          | 1.0   |
| Loss, .....                   | 12.0  |
|                               | <hr/> |
|                               | 200.4 |

The *kankar* formation is very abundant along the Cawnpore bank of the Ganges, but the new sandstone formation of Bundelkhand, (which is the nearest approach I am aware of,) must be further, even from the sulphate of soda deposit of Unaú, than the Ghazipúr saline deposit described by the Rev. R. Everest.

Ságar, Aug. 14, 1832.

VI.—*Eclipses of Jupiter's Satellites.*

[Observed at *Chuprah*, Lat.  $25^{\circ} 47' 26''$  N., Long. 5h. 39m. 7s. E. by Mr. Walter Ewer.]

|              |                         | Mean Time. |    |      | Difference from<br>Greenwich. |
|--------------|-------------------------|------------|----|------|-------------------------------|
|              |                         | h.         | m. | s.   |                               |
| 2nd October, | Emersion of Sat. II. at | 7          | 57 | 56.3 | very clear. 5 39 04.3         |
| 3rd Ditto,   | Emersion of Sat. I. at  | 9          | 53 | 50   | ditto. 5 39 12                |
| 19th Ditto,  | Ditto at                | 8          | 13 | 32   | ditto. 5 39 02                |

Troughton's 5 feet achromatic, power about 200, aperture 3.8 inches. This telescope has been 25 years in the country, and is in excellent order.

*Observations in Calcutta.*

19th October, 1832.—On this day by the Ephemeris the whole of Jupiter's satellites were to be eclipsed, and of the phenomena no less than four out of six, viz. two immersions and two emersions, should have been visible at Calcutta. The weather having been unusually fine and clear for some days past, it was thought to be a good opportunity for trying the power of the superb reflecting telescope, lately presented to Mr. James Calder, by Sir John Herschell:—one of the last made under his father's directions. The following gentlemen undertook to make simultaneous observations with their own telescopes, by way of ascertaining the extent of uncertainty in the use of different instruments under precisely similar circumstances: Captain D. Ross, Marine Surveyor General, at his residence in Chowringhee, and his assistant Lieut. Lloyd, with a second telescope at the same place; Captain Wilcox, Mr. Logan, and Lieutenant Waugh, at the Surveyor General's office, in Park Street; Mr. H. Barrow, H. C. Mathematical instrument maker, in Loudon Street, Chowringhee; and Mr. Gray, at his observatory in Garstin's Buildings; while Lieut. Pemberton with his own telescope, Mr. Gordon with his, and myself at the large reflector, should make the observation at Mr. Calder's residence in Esplanade-row.

The evening proved hazy, and it was only at intervals that Jupiter could be seen to advantage; still, however, with all three telescopes, and particularly with the large reflector, the belts and satellites were distinctly visible through the haze. The immersion of the fourth satellite expected at 8h. 17m. 30s. was not visible on account of the mist—indeed the satellite had disappeared several minutes previously, or when we first stationed ourselves at our glasses. The emersion of the same at 11h. 3m. 20s. and the immersion of the third at 16h. 48m. 9s. were likewise lost from the same cause; so that the emersion of the first satellite, was the only one we were fortunate enough to obtain. The sky too was less hazy at that moment, and the belts were distinctly

marked : still the observation was under unfavourable circumstances, and affords results applicable only to such. To save trouble all the observations have been reduced to the same meridian, namely, that of the Ochterlony monument, by applying—2 sec. to those of the Surveyor Genl. Capt. Ross, and Mr. Barrow, and + 1 sec. to those of Mr. Gray : during the remainder of the month other observations were made in a similar manner :—they have been reduced to the same meridian, and the telescopes used are distinguished by letters of reference. P.

19th October.—Emersion of Jupiter's first satellite, Calcutta.

| Observer.  | Telescope.               | Aperture. | Power. | Note.      | Obs. Me. Ti. | Longitude. |
|------------|--------------------------|-----------|--------|------------|--------------|------------|
| Prinsep,   | a. ten-foot reflector    | 9 in.     | 160    | hazy       | 8 27 58      | 5 53 28    |
| Pemberton, | b. four-foot achrom.     | 3.7       | 110    | do.        | 8 27 59      | 5 53 29    |
| Gray,      | c. 42 in. achromatic,    | 2.7       | 80     | do.        | 8 28 12      | 5 53 42    |
| Logan,     | c. 42 in. ditto, . . . . | 2.7       | 80     | do.        | 8 28 05      | 5 53 35    |
| Ross,      | c. 42 in. ditto, . . . . | 2.7       | 80     | dull glass | 8 28 37      | 5 54 07    |

26th October.—Emersion of I Sat. observed in Calcutta.

|                      |            |                            |          |         |
|----------------------|------------|----------------------------|----------|---------|
| At the Surv. Gen.'s, | Wilcox,    | c. [12. in. 2.7 ap. 80 p.] | 10 23 15 | 5 53 05 |
|                      | Waugh,     | c.                         | 10 23 41 | 5 53 31 |
|                      | Logan,     | c.                         | 10 23 25 | 5 53 15 |
| At Mr. Calder's,     | Pemberton, | b. [4 ft.achr.]            | 10 24 09 | 5 53 59 |
|                      | Prinsep,   | a. [10 ft.ref.]            | 10 24 09 |         |
| * At Mr. Gray's,     | Gray,      | c.                         | 10 24 01 | 5 53 51 |

drifting clouds were passing the planet from the N. W. at the moment, and when the satellite was first seen, it had evidently been some seconds out of eclipse. There were eight seconds between the two last observations, which was about the time occupied by the cloud in passing from one station to the other. The sky was cloudless in Chowringhee.

3rd Nov.—Emersion of II Sat. observed by Mr. Gray, tel. c. h. m. s. h. m. s.  
7 52 8 5 53 20

4th Nov.—Emersion of I Sat. observed ;

By Captain Ross, with telescope c. 42 inches.

6 18 38 5 53 46

By Lieut. Lloyd, with the telescope used by Captain Ross on the 19th ultimo, the object glass tarnished, the emersion was not visible until 14 seconds after. The evening was very favorable and clear.

By Mr. Logan, at the Sur. Gl. office.

c. 6 48 12 5 53 20

10th Nov.—Calcutta, very clear sky ; moonlight, (16th day.)

Emersion of III. Sat. Gray, telescope

c. very good 7 54 5 5 53 33

Gordon, d. 60 in. 3.7 ap.

110 p. doubtful, 7 54 56 5 54 34

Logan, d. 60 in. 3.7 ap.

99 p. moonlight, 7 53 41 5 53 19

Em. II. Sat. Prinsep, 10 feet Refl.

a. bad focus, 10 27 17 5 52 53

Gordon,

b. good, 10 27 27 5 53 03

Gray,

c. good, 10 27 27 5 53 03

Logan,

c. 10 27 32 5 53 08

|                          |                    |                |          |         |
|--------------------------|--------------------|----------------|----------|---------|
| 11th Nov.—Em. I. Sat.    | Prinsep,           | b. very good,  | 8 43 57  | 5 53 12 |
|                          | Gordon,            | d. do.         | 8 44 05  | 5 53 20 |
|                          | Logan,             | d. do.         | 8 43 48  | 5 53 03 |
|                          | Barrow, (power 70) | c. do.         | 8 44 32  | 5 53 47 |
| 17th Nov. Imm. III. Sat. | Barrow,            | c. do.         | 9 0 43   | 5 54 34 |
| 18th Nov.—Em. I. Sat.    | Gordon,            | d. very clear, | 10 40 01 | 5 53 19 |
|                          | Prinsep,           | b. do.         | 10 39 47 | 5 53 05 |
|                          | Wilcox,            | c. do.         | 10 39 50 | 5 53 08 |
|                          | Logan,             | d. do.         | 10 39 43 | 5 53 01 |
|                          | Barrow,            | c. do.         | 10 40 06 | 5 53 24 |
| 27th Nov.—Em. I. Sat.    | Gray,              | c. good,       | 7 5 10   | 5 53 10 |
|                          | Logan,             | c. doubtful,   | 7 5 15   | 5 53 32 |
|                          | Barrow,            | c. do.         | 7 5 22   | 5 53 39 |

**VII.—Abstract of Observations of the Temperature, Pressure, and Hygrometrical state of the Air in the vicinity of Dehli. By Major Oliver.**

The observations were made at various places within the Dehli territory, not exceeding 50 miles distance from the city, and generally much less. It would of course have been more satisfactory had they been made at one and the same place, but I was not stationary and had not always the opportunity of making my observations at the most favourable hours: notwithstanding these disadvantages, I trust it will be thought that the mean results are at least as consistent as could reasonably be expected.

Referring to table I, my barometer is one of Dollond's: it was compared five or six years ago with the one then used in the Surveyor General's office, when it stood .055 higher than the latter: the reduction has been made accordingly. The mean daily range during these eleven months, appears to be too little; but on taking the mean of a long series of observations made in camp, I find the mean is .103. I had no observations at Gurgaon in April, but as the Barometer in that month stands at nearly its mean height, the want of these is perhaps of little consequence. It will be observed, that there is an extreme difference of about 120 feet in the elevation of Gurgaon above Calcutta, as deduced from the observations at the two places for the several months: when it is considered that each of the results in the Table is deduced from the mean of about sixty observations at each place, it is evident how little dependence can be placed on the results of single observations at places so far distant\*.

\* The difference of the altitudes deduced from the monthly means, is just of the nature which was anticipated in consequence of the annual barometrical range increasing with the latitude; (vide page 30 of this Journal,) for all places in India north of Calcutta, the summer observations will give too high an altitude,—the winter, one too low: for southern latitudes the reverse will occur. We hope to furnish a correction for this hereafter.—ED.



The observations in table II, were made at various places within the limits already mentioned. The mean temperature of each month has been deduced generally, from the observations at sunrise and  $2\frac{1}{2}$  p. m. ; but occasionally (when others were wanting) from the observation at sunset only ; in the latter case  $3^{\circ}$  have been deducted from the temperature at that time : as I find from the mean of a long series of observations, that the temperature at sunset is  $3^{\circ}$  above the mean of maximum and minimum. For the temperature of the night I have taken the mean of sunset and sunrise.

In Table III, for the dew points (headed S in the table) I have used the formula ( $f = F' - 6.056 \frac{D^{1.779}}{L} - \frac{B}{30}$ ) given in the GLEANINGS for July 1829, page 192, altering the constant 6.056 to 5.84, for, when I received this number of the GLEANINGS, having by me Daniell's Meteorological Essays, and finding that the table of the force of vapour there given, page 596, differed from the one used by the author of the valuable paper above referred to, I had the curiosity to calculate the value of  $\frac{A}{e}$  (see the paper same page) and found it  $\approx 5.84$  ; the difference is not perhaps very material, but as I have always used the table of the force of vapour given in Daniell's Essay above quoted, I thought it more consistent to use the constant modified accordingly. The two last columns of table III, (mean dew point and mean comparative tension) have been thus formed : the mean dew point is the mean of all the observations (or rather of all the results derived from the wet thermometer depressions) for several months : the force of vapour answering to the mean dew point, divided by that answering to the mean temperature of the month, gives the mean comparative tension. I have adopted this mode, not only from my having by necessity or choice so often altered my hours of observing, but from the consideration that as the dew point generally varies but little during the day, it appeared to me that it would be more accurate to deduce the mean comparative tensions from even one observation of the dew point and the mean temperature, than by taking it as the mean of results calculated for any two or more hours, not excepting even sunrise and  $2\frac{1}{2}$  p. m. How far I may be right in this, I leave to more competent judges to decide.

Table IV, is nothing more than an abstract of table III, the force of vapour at the dew point being substituted for the dew point itself. It appears, that May is the driest and August the dampest month, considering the comparative tensions as the fairest scale of the humidity of

the air. There is a less quantity of aqueous vapour in a given quantity of air in January than in May, but the difference of temperature makes the drying power of the air in the latter month superior to that in the former. I find by a rough calculation that the weight of aqueous vapour in a cubic foot of air varies from 3.3 grains in January to 10.3 in August. Comparing the driest month at Dehli with the driest, in Calcutta, I find the ratio as 5 to 3 nearly: the dampest month is nearly the same at both places, and the mean of the year as 5 to 4 nearly: I should have expected a much greater difference.

I have added a table of the factor  $\left(5.84 \frac{D^{1.233}}{L}\right)$  for finding the dew point from observations of the temperature of the air and that of the wet thermometer; also the table of the force of vapour which I have used in my reductions: should these be thought worth printing, it will be as well to give an example of their use to prevent misconception. Suppose the temperature of the air  $100^{\circ}$ , that of the wet thermometer  $70^{\circ}$   $\therefore D = 30^{\circ}$ , the barometer standing at 27.0 inch; required the dew point and comparative tension?

For wet thermometer  $70^{\circ}$  and  $D = 30^{\circ}$  Table IV. gives .402

For barometer 27.0 inch, deduct  $.402 \times .1 = .040$

.362

Force of vapour at  $70^{\circ}$

.723

Dew point  $49^{\circ}.9$ —force of vapour answering thereto = .361 log. = 9.55751

Force of vapour at temp. of air  $100^{\circ} = 1.874$  colog. = 9.72723

Comparative tension = 0.193 = 9.28474

TABLE I. *Barometer reduced to 32°, and Temperature of the external Air observed at Gurgaon.*

| Year and Month. | 10 A. M. |       | 4 P. M. |       | MEAN.  |       | Daily range of Bar. | Monthly difference from mean. | Elevation of Gurgaon above Calcutta. |
|-----------------|----------|-------|---------|-------|--------|-------|---------------------|-------------------------------|--------------------------------------|
|                 | Bar.     | Temp. | Bar.    | Temp. | Bar.   | Temp. |                     |                               |                                      |
|                 | in.      | °     | in.     | °     | in.    | °     |                     |                               |                                      |
| May, 1829.      | 28.832   | 100.6 | 28.712  | 107.6 | 28.772 | 104.1 | .120                | — .182                        | 868                                  |
| June, ....      | .813     | 96.1  | .714    | 100.5 | .763   | 98.3  | .099                | — .191                        | 841                                  |
| July, ....      | .717     | 84.0  | .646    | 87.0  | .682   | 85.5  | .071                | — .272                        | 855                                  |
| August, ....    | .791     | 83.9  | .711    | 85.8  | .751   | 81.8  | .080                | — .203                        | 803                                  |
| September,      | .882     | 86.6  | .798    | 91.7  | .840   | 89.2  | .084                | — .114                        | 807                                  |
| October, ..     | 29.034   | 84.5  | .955    | 91.1  | .995   | 87.8  | .079                | — .041                        | 808                                  |
| November,       | .223     | 72.7  | 29.143  | 79.1  | 29.183 | 75.9  | .080                | + .229                        | 750                                  |
| December,       | .255     | 62.4  | .158    | 71.3  | .207   | 66.8  | .079                | + .253                        | 771                                  |
| Jan. 1830.      | .230     | 66.0  | .140    | 74.9  | .185   | 70.5  | .090                | + .231                        | 854                                  |
| February,       | .153     | 69.8  | .067    | 76.0  | .110   | 72.9  | .086                | + .156                        | 813                                  |
| March, ..       | .052     | 77.3  | 28.963  | 83.4  | .008   | 80.4  | .089                | + .054                        | 814                                  |
| April, ....     | ..       | ..    | ..      | ..    | ..     | ..    | ..                  | ..                            | ..                                   |
|                 |          |       |         |       | 28.954 |       | .089                |                               | 817                                  |

TABLE II. Mean Temperature of each month for three years, as observed at various places in the vicinity of Dehli.

|                | 1827. |        | 1828. |        | 1829. |        | Means. |        | Difference from Mean. |        |
|----------------|-------|--------|-------|--------|-------|--------|--------|--------|-----------------------|--------|
|                | day.  | night. | day.  | night. | day.  | night. | day.   | night. | day.                  | night. |
| January, ..    | 56.7  | 51.4   | 53.7  | 50.3   | 58.4  | 53.5   | 56.3   | 51.7   | - 19.7                | - 19.1 |
| February, ..   | 66.0  | 58.6   | 56.8  | 51.8   | 62.0  | 53.8   | 61.6   | 55.4   | - 14.4                | - 15.4 |
| March, ....    | 74.0  | 66.0   | 70.6  | 63.8   | 73.0  | 66.0   | 72.5   | 65.3   | - 3.5                 | - 5.5  |
| April, ....    | 83.8  | 75.5   | 79.3  | 74.2   | 86.6  | 77.9   | 83.2   | 75.9   | + 7.2                 | + 5.1  |
| May, .....     | 90.4  | ..     | 87.0  | 82.2   | 96.7  | 88.9   | 91.1   | 85.6   | + 15.1                | + 14.8 |
| June, .....    | 91.7  | ..     | 93.7  | 90.4   | 92.0  | 90.0   | 92.5   | 90.2   | + 16.5                | + 19.1 |
| July, .....    | 90.1  | ..     | 88.2  | 85.5   | 79.7  | 80.6   | 86.0   | 83.0   | + 10.0                | + 12.2 |
| August, .....  | 85.5  | ..     | 83.6  | 80.9   | 82.5  | 79.1   | 83.9   | 80.1   | + 7.9                 | + 9.3  |
| September, ..  | 83.2  | 79.3   | 83.2  | ..     | 81.7  | 77.6   | 83.4   | 78.5   | + 7.1                 | + 7.7  |
| October, ..... | 77.7  | 70.2   | 76.2  | 71.6   | 77.5  | 72.4   | 77.1   | 71.1   | + 1.1                 | + 0.6  |
| November, ..   | 65.7  | 60.3   | 65.2  | 55.2   | 65.8  | 61.7   | 65.6   | 59.1   | + 10.1                | + 11.7 |
| December, ..   | 57.1  | 53.1   | 62.3  | 54.8   | 57.3  | 52.1   | 58.9   | 53.3   | - 17.1                | - 17.5 |
| Means, ....    | 76.8  | ..     | 75.2  | ..     | 76.1  | 71.3   | 76.0   | 70.8   | ..                    | ..     |

The mean of six observations of the temperature of water in wells from 74 to 94 feet deep gives 74°.0 : varying from 71° to 78°.

TABLE III. Temperature of the Air—Depression of Moist Thermometer (D), Point of Saturation (S), or the dew Point, and mean comparative Tension, (T.)

| Year and Month.   | 1827. |      |      | 1828. |      |      | 1829. |      |      |
|-------------------|-------|------|------|-------|------|------|-------|------|------|
|                   | Temp. | D.   | S.   | Temp. | D.   | S.   | Temp. | D.   | S.   |
|                   | °     | °    | °    |       |      |      |       |      |      |
| April, 1827. .... | 67.0  | 8.9  | 52.4 |       |      |      |       |      |      |
| May, .....        | 77.5  | 9.9  | 63.5 |       |      |      |       |      |      |
| June, .....       | 82.1  | 9.1  | 69.0 |       |      |      |       |      |      |
| July, .....       | 82.1  | 6.3  | 73.8 |       |      |      |       |      |      |
| August, .....     | 79.3  | 2.7  | 75.9 |       |      |      |       |      |      |
| September, .....  | 71.9  | 2.3  | 72.0 |       |      |      |       |      |      |
| October, .....    | 61.5  | 4.9  | 53.8 |       |      |      |       |      |      |
| November, .....   | 49.7  | 4.1  | 42.4 |       |      |      |       |      |      |
| December, .....   | 46.5  | 0.8  | 45.2 |       |      |      |       |      |      |
| January, 1828. .. | 43.8  | 1.2  | 41.8 |       |      |      |       |      |      |
| February, .....   | 42.3  | 1.5  | 39.7 |       |      |      |       |      |      |
| March, .....      | 52.5  | 5.1  | 43.4 |       |      |      |       |      |      |
| April, .....      | 63.1  | 8.3  | 48.7 |       |      |      |       |      |      |
| May, .....        | 71.3  | 11.0 | 46.0 |       |      |      |       |      |      |
| June, .....       | 82.8  | 11.9 | 65.5 | 96.5  | 20.7 | 66.0 |       |      |      |
| July, .....       | 81.7  | 5.2  | 75.0 | 92.3  | 12.6 | 75.4 |       |      |      |
| August, .....     | 78.4  | 0.8  | 77.5 | 85.0  | 6.0  | 77.3 |       |      |      |
| September, .....  |       |      |      | 87.0  | 7.8  | 76.8 |       |      |      |
| October, .....    |       |      |      | 87.0  | 11.0 | 66.8 |       |      |      |
| November, .....   |       |      |      | 72.0  | 14.0 | 47.2 | 76.0  | 17.0 | 41.8 |
| December, .....   |       |      |      |       |      |      | 73.0  | 13.0 | 50.8 |
| January, 1829. .. |       |      |      |       |      |      | 68.0  | 12.0 | 46.4 |
| February, .....   |       |      |      |       |      |      | 74.0  | 15.0 | 47.3 |
| March, .....      |       |      |      |       |      |      | 90.0  | 23.2 | 50.2 |
| April, .....      |       |      |      |       |      |      | 99.0  | 30.0 | 45.5 |
| May, .....        |       |      |      | 100.6 | 26.0 | 60.2 |       |      |      |
| June, .....       |       |      |      | 96.1  | 17.5 | 71.7 |       |      |      |
| July, .....       |       |      |      | 81.0  | 5.0  | 77.7 |       |      |      |
| August, .....     |       |      |      | 83.9  | 4.9  | 77.7 |       |      |      |
| September, .....  |       |      |      | 86.6  | 11.9 | 70.0 |       |      |      |
| October, .....    |       |      |      | 81.5  | 18.4 | 54.2 |       |      |      |
| November, .....   |       |      |      | 72.7  | 15.4 | 44.1 |       |      |      |
| December, .....   |       |      |      | 62.4  | 13.0 | 35.0 |       |      |      |
| January, 1830. .. |       |      |      | 66.0  | 14.7 | 35.2 |       |      |      |
| February, .....   |       |      |      | 69.8  | 8.8  | 55.9 |       |      |      |
| March, .....      |       |      |      | 77.3  | 15.8 | 49.8 |       |      |      |

TABLE III. (continued.)

| Year and Month.      | 2.40 P. M. |      |      | 4 P. M. |      |      | Sunset. |      |      | Mean. |      |
|----------------------|------------|------|------|---------|------|------|---------|------|------|-------|------|
|                      | Temp.      | D.   | S.   | Temp.   | D.   | S.   | Temp.   | D.   | S.   | S.    | T.   |
| April, 1827...       | 100.5      | 30.3 | 47.8 |         |      |      | 84.1    | 19.1 | 51.7 | 50.1  | .320 |
| May, ..              | 103.2      | 29.8 | 55.0 |         |      |      |         |      |      | 59.2  | .359 |
| June, ..             | 101.4      | 24.1 | 65.8 |         |      |      |         |      |      | 67.4  | .456 |
| July, ..             | 98.1       | 18.4 | 72.5 |         |      |      |         |      |      | 73.2  | .581 |
| August, ..           | 91.8       | 11.4 | 76.7 |         |      |      |         |      |      | 76.3  | .744 |
| September, ..        | 92.2       | 14.0 | 73.0 |         |      |      | 83.8    | 8.7  | 72.0 | 72.5  | .706 |
| October, ..          | 94.0       | 25.8 | 49.5 |         |      |      | 78.9    | 16.7 | 50.0 | 51.7  | .412 |
| November, ..         | 81.8       | 21.4 | 40.8 |         |      |      | 70.9    | 15.3 | 41.3 | 41.6  | .425 |
| December, ..         | 67.7       | 10.5 | 49.6 |         |      |      | 59.8    | 5.5  | 50.7 | 47.4  | .706 |
| Jan. 1828. ..        | 63.6       | 9.2  | 47.4 |         |      |      | 56.8    | 5.5  | 47.5 | 44.6  | .723 |
| February, ..         | 71.3       | 16.7 | 37.7 |         |      |      | 61.3    | 10.4 | 41.3 | 38.7  | .518 |
| March, ..            | 88.8       | 27.0 | 34.2 |         |      |      | 75.0    | 18.2 | 40.0 | 38.7  | .324 |
| April, ..            | 95.5       | 28.6 | 43.0 |         |      |      | 85.3    | 23.3 | 41.0 | 45.9  | .317 |
| May, ..              | 103.0      | 33.0 | 43.3 |         |      |      | 93.0    | 24.1 | 52.7 | 44.7  | .238 |
| June, ..             | 104.7      | 27.9 | 62.1 | 101.5   | 24.7 | 64.6 | 97.9    | 24.3 | 60.6 | 63.8  | .379 |
| July, ..             | 94.8       | 15.2 | 74.0 | 93.6    | 15.1 | 72.8 | 89.2    | 11.7 | 73.3 | 74.5  | .644 |
| August, ..           | 88.7       | 8.3  | 77.9 | 87.0    | 7.0  | 78.0 | 83.4    | 3.9  | 78.6 | 77.7  | .827 |
| September, ..        |            |      |      | 88.0    | 9.9  | 74.8 |         |      |      | 75.8  | .738 |
| October, ..          |            |      |      | 92.0    | 22.0 | 56.5 |         |      |      | 61.7  | .615 |
| November, ..         |            |      |      | 79.0    | 20.0 | 40.3 |         |      |      | 44.1  | .475 |
| December, ..         |            |      |      |         |      |      |         |      |      | 50.8  | .668 |
| Jan. 1829, ..        |            |      |      |         |      |      |         |      |      | 46.4  | .651 |
| February, ..         |            |      |      |         |      |      |         |      |      | 47.3  | .595 |
| March, ..            |            |      |      |         |      |      |         |      |      | 50.2  | .457 |
| April, ..            |            |      |      |         |      |      |         |      |      | 45.5  | .248 |
| May, ..              |            |      |      | 107.6   | 33.3 | 52.3 |         |      |      | 56.2  | .265 |
| June, ..             |            |      |      | 100.5   | 23.2 | 66.4 |         |      |      | 69.0  | .476 |
| July, ..             |            |      |      | 87.0    | 7.0  | 78.0 |         |      |      | 77.8  | .941 |
| August, ..           |            |      |      | 85.8    | 6.7  | 77.5 |         |      |      | 77.6  | .854 |
| September, ..        |            |      |      | 91.7    | 15.8 | 69.2 |         |      |      | 69.6  | .671 |
| October, ..          |            |      |      | 91.1    | 25.6 | 44.5 |         |      |      | 49.4  | .382 |
| November, ..         |            |      |      | 79.1    | 20.6 | 38.3 |         |      |      | 41.2  | .417 |
| December, ..         |            |      |      | 71.3    | 18.1 | 32.5 |         |      |      | 33.8  | .424 |
| Jan. 1830. ..        |            |      |      | 74.9    | 20.5 | 29.6 |         |      |      | 32.4  | .394 |
| February, ..         |            |      |      | 76.0    | 14.1 | 52.3 |         |      |      | 54.1  | .654 |
| March, ..            |            |      |      | 83.4    | 21.9 | 42.0 |         |      |      | 45.9  | .416 |
| Mean first year,     |            |      |      |         |      |      |         |      |      | 55.1  | .523 |
| second,              |            |      |      |         |      |      |         |      |      | 56.9  | .550 |
| third,               |            |      |      |         |      |      |         |      |      | 54.4  | .512 |
| Mean of three years, |            |      |      |         |      |      |         |      |      | 55.5  | .528 |

TABLE IV. Comparative Tension, (T.) and Force of vapour at the Dew point, (F.)

|                 | T.   | F.              |      | T.               | F.   |                 | T.        | F.   |      | T.   | F. |
|-----------------|------|-----------------|------|------------------|------|-----------------|-----------|------|------|------|----|
| Ap. 1827. .320  | .363 | Ap. 1828, .317  | .312 | April, ..        | .248 | .308            | April, .. | .295 | .328 |      |    |
| May, .. .359    | .501 | May, .. .238    | .299 | May, .. .265     | .450 | May, .. .287    | .417      |      |      |      |    |
| June, .. .456   | .663 | June, .. .379   | .586 | June, .. .476    | .699 | June, .. .437   | .649      |      |      |      |    |
| July, .. .581   | .804 | July, .. .644   | .840 | July, .. .941    | .936 | July, .. .722   | .860      |      |      |      |    |
| August, .. .744 | .891 | August, .. .827 | .933 | August, .. .854  | .930 | August, .. .808 | .918      |      |      |      |    |
| Sept. .706      | .786 | Sept. .. .738   | .876 | Sept. .. .671    | .713 | Sept. .. .705   | .792      |      |      |      |    |
| October, .412   | .384 | Oct. .. .615    | .546 | October, .. .382 | .354 | Oct. .. .470    | .428      |      |      |      |    |
| Nov. .425       | .266 | Nov. .. .475    | .292 | Nov. .. .417     | .262 | Nov. .. .439    | .273      |      |      |      |    |
| Dec. .706       | .329 | Dec. .. .668    | .372 | Dec. .. .424     | .199 | Dec. .. .599    | .300      |      |      |      |    |
| Jan. 1828, .723 | .298 | Jan. 1829, .651 | .317 | Jan. 1830, .394  | .189 | Jan. .. .589    | .268      |      |      |      |    |
| February, .518  | .239 | Feb. .. .595    | .328 | Feb. .. .654     | .418 | Feb. .. .589    | .328      |      |      |      |    |
| March, .. .325  | .234 | March, .. .457  | .365 | March, .. .416   | .312 | March, .. .399  | .305      |      |      |      |    |
| Means. .523     | .480 |                 | .550 | .506             |      | .512            | .481      |      | .528 | .489 |    |

TABLE V. For finding the dew Point from the Temperature of the Air, and that of the Wet Thermometer.

| D.<br>° | Temperature of the Wet Thermometer. |      |      |      |      |      |      |      |      |      |
|---------|-------------------------------------|------|------|------|------|------|------|------|------|------|
|         | 110°                                | 100° | 90°  | 80°  | 70°  | 60°  | 50°  | 40°  | 30°  | 20°  |
| 1°      | .006                                | .006 | .006 | .006 | .006 | .006 | .007 | .007 | .007 | .007 |
| 2       | .013                                | .013 | .013 | .014 | .014 | .014 | .014 | .014 | .015 | .015 |
| 3       | .021                                | .022 | .022 | .023 | .023 | .023 | .024 | .024 | .025 | .025 |
| 4       | .030                                | .031 | .032 | .032 | .033 | .034 | .035 | .035 | .036 | .037 |
| 5       | .040                                | .041 | .042 | .043 | .044 | .045 | .046 | .047 | .048 | .049 |
| 6       | .051                                | .052 | .053 | .054 | .055 | .056 | .057 | .058 | .060 | .061 |
| 7       | .062                                | .063 | .065 | .066 | .067 | .068 | .070 | .071 | .073 | .075 |
| 8       | .073                                | .074 | .076 | .077 | .079 | .081 | .082 | .084 | .086 | .089 |
| 9       | .084                                | .085 | .087 | .089 | .091 | .093 | .095 | .097 | .100 | .103 |
| 10      | .095                                | .097 | .099 | .101 | .104 | .106 | .109 | .111 | .114 | .117 |
| 11      | .107                                | .109 | .111 | .114 | .116 | .119 | .122 | .125 | .128 |      |
| 12      | .120                                | .122 | .124 | .127 | .130 | .133 | .136 | .139 | .142 |      |
| 13      | .132                                | .134 | .137 | .140 | .143 | .146 | .150 | .153 | .156 |      |
| 14      | .145                                | .147 | .150 | .154 | .157 | .160 | .164 | .168 | .171 |      |
| 15      | .157                                | .160 | .164 | .168 | .171 | .175 | .179 | .183 | .187 |      |
| 16      | .170                                | .174 | .177 | .181 | .185 | .190 | .194 | .198 | .203 |      |
| 17      | .183                                | .187 | .191 | .195 | .199 | .204 | .209 | .214 |      |      |
| 18      | .196                                | .200 | .205 | .209 | .214 | .218 | .224 | .229 |      |      |
| 19      | .210                                | .215 | .219 | .224 | .229 | .234 | .239 | .245 |      |      |
| 20      | .224                                | .229 | .233 | .239 | .244 | .250 | .256 | .261 |      |      |
| 21      | .238                                | .243 | .247 | .253 | .259 | .265 | .272 | .278 |      |      |
| 22      | .252                                | .258 | .263 | .269 | .276 | .282 | .289 | .295 |      |      |
| 23      | .266                                | .272 | .278 | .284 | .290 | .297 | .305 |      | Bar. | Mul. |
| 24      | .281                                | .286 | .292 | .299 | .306 | .313 | .321 |      | 29.5 | .02  |
| 25      | .295                                | .301 | .307 | .314 | .321 | .329 | .337 |      | 29.0 | .03  |
| 26      | .309                                | .316 | .323 | .330 | .337 | .345 | .353 |      | 29.5 | .05  |
| 27      | .324                                | .331 | .339 | .347 | .354 | .362 | .370 |      | 28.0 | .07  |
| 28      | .339                                | .346 | .354 | .362 | .370 | .379 | .388 |      | 27.5 | .08  |
| 29      | .354                                | .362 | .370 | .378 | .386 | .395 |      |      | 27.0 | .10  |
| 30      | .369                                | .377 | .385 | .394 | .402 | .411 |      |      | 26.5 | .12  |
| 31      | .385                                | .393 | .402 | .411 | .420 | .429 |      |      | 26.0 | .13  |
| 32      | .400                                | .408 | .417 | .427 | .437 | .447 |      |      | 25.5 | .15  |
| 33      | .416                                | .425 | .434 | .444 | .454 | .464 |      |      | 25.0 | .17  |
| 34      | .431                                | .440 | .450 | .460 | .470 | .480 |      |      | 24.5 | .18  |
| 35      | .447                                | .457 | .467 | .476 | .487 |      |      |      | 21.0 | .20  |
| 36      | .462                                | .472 | .482 | .493 | .504 |      |      |      | 23.5 | .22  |
| 37      | .478                                | .488 | .499 | .510 |      |      |      |      | 23.0 | .23  |
| 38      | .494                                | .505 | .516 | .527 |      |      |      |      | 22.5 | .25  |
| 39      | .510                                | .521 | .532 |      |      |      |      |      | 22.0 | .27  |
| 40      | .526                                | .538 | .549 |      |      |      |      |      |      |      |

N.B.—The numbers in this Table to be multiplied by  $\frac{B}{30}$ , B being the height of the Barometer or, which will be easier, deduct therefrom the product of the tabular number by the multiplier opposite the height of the barometer in the small table above\*.

\* We omit Table VI. of the Force of Vapour, because it may be found in any physical or chemical work; besides which, the tensions of vapour at temperatures between 60 and 120, require to be more accurately determined for the present state of atmospheric knowledge.—Ed.

IX.—*Proceedings of the Asiatic Society.**Wednesday, 7th November, 1832.*

THE HONORABLE SIR EDWARD RYAN, President, in the Chair.

Read the proceedings of the last Meeting.

The following Members were ballotted for, and unanimously elected :—  
Monsieur Richy, Captain Sage, Rajah Kalikrishen:

The communication from Baron Ferussac, referred to the Committee of Papers at the last Meeting, having been considered by them, they report, that they consider it inadvisable to take any share, but recommend to the Society to subscribe for a complete annual set of the *Bulletin Universel*.

With regard also to the List of Books submitted by Dr. Tytler, the Committee recommend, that only such as have an oriental character be purchased.—Resolved, that the recommendations of the Committee be adopted.

The Secretary reported the completion of the 17th volume, also the preparation of an ample Index to the first 17 volumes.—Resolved that the Index be printed.

The Secretary to the Physical Class reported, that it had been determined to recommend a further grant of 500 rupees for the Boring Experiment, on condition of that being the last grant to be made by the Society.—Resolved, that the grant, subject to the stipulation, be confirmed.

Resolved also, as a matter of general convenience, that in future the Proceedings of the Physical Class shall form part of the business of the General Meetings, which shall be held once a month on the first Wednesday, as heretofore.

*Museum.*

An Image of Bhairava. Presented through Dr. Twining on the part of General O'Halloran.

This image of Mahadeo was found at Bijrah Ghat, situated in a wild jungle on the right bank of the Nerbadda, on the rout from Jabalpur to Garwarreh, about 14 miles from the former town, and about three miles from the high road; it is approached through heavy ravines.

On the top of a circular hill, about 150 feet high, in the centre is a temple dedicated to Mahadeo, and on its brow, surrounding the temple, is an arcade, divided into 72 compartments, in each of which is a large image, of good workmanship, more or less mutilated, as tradition states, by the army of Aurangzeb, when in progress to the Dekhin. At the foot of this hill, and at a small distance, close to a temple, falling into decay, the above image was found, and conveyed to Sagar, and from thence to Calcutta.

The arcades on the crest of the hill appear to be very ancient, and are built of large stones, without cement.

Bijrah Ghat is considered as a sacred spot, where an immense crowd of pilgrims congregate three days in the year, for the purpose of traffic and devotion.

A figure of Nemnáth. Presented through Mr. Kyd.

Read a letter from Captain Boileau, presenting several coins dug up at Agra.

The Secretary reported, that the Committee had authorised the purchase of a set of Roman Coins. A list of which, prepared by Mr. Prinsep, was submitted.

The head of a Saw-fish. Presented by Mr. Hutchinson.

The thanks of the Society were voted for the above.

*Library.*

Read a letter from Counsellor Von Hammer, presenting the following works :

1. 8th Vol. of the Ottoman History.
  2. Persian Translation of the Meditations of Marcus Antoninus.
  3. Account of Oriental Manuscripts in the Library of Turin.
  4. Nos. 53 to 56 of the *Jahrbucher* of Vienna.
- "The Ass overladen." Presented by Mr. Fisher.

Read a letter from the Secretary to the Royal Academy of Bourdeaux, presenting 2 vols. of their Proceedings.

Transactions of the Geological Society, part 2nd of the 3rd Vol. presented by the Society.

Notes on the *Hitopodesa*, by Messrs. Schlegel and Lassen. By the authors.

New edition of De Sacy's Arabic Grammar. By the author.

Memoir on the Mussulman Religion in India, by M. Garcin de Tassy. By the author.

2 small Persian Manuscripts on Astrology, &c. By Ensign Readbold.

Meteorological Journals for August and September, 1832. By the Surveyor General.

Resolved, that the thanks of the Society be returned for the above.

The Secretary reported the purchase of the following Books.

1. Franklin's Observations made on a tour from Bengal to Persia, 1 vol.
2. Scott's *Ferishta's History of Dekhan*, 2 do.
3. *Bentley's Hindu Astronomy*, 1 do.

*Literary.*

Translation of an extensive *Bauddha Vocabulary and Abstract of a Tibetan Medical work*. Made and presented by Mr. Csoma de Körös.

A notice of some of the Arabic Poets. By Ensign Readbold.

An Abstract Account of the contents of the volumes presented by Ensign Readbold. By Baboo Ramdhun Shèn.

Read Extracts from a Letter from Major Burney, from Ava, to the Secretary, regarding the historical records of that country.

Inscriptions from Vijayanagar, with translations and a pedigree of the Kings of that city. Presented by Mr. Ravenshaw.

Read also observations on the same by the Secretary.

The thanks of the Society voted for the above, and the papers referred to the Committee.

## IX.—SCIENTIFIC INTELLIGENCE.

*Slate Quarries in the Western Ghâts.*

From official reports lately communicated from the Bombay Government to this presidency, with the perusal of which we have been kindly favored, we learn that Lieut. Jervis of the Bombay Engineers has brought forward propositions for the working of quarries in the extensive clay slate formations in the southern Marhatta country. That officer has sent down specimens of slates adapted to the several purposes of roofing, flooring, monumental stones, dials, dripstones, whet-stones, and drawing slates; accompanied with samples of marble, porphyry, lithographic stone, mill-stone, sand-stone, &c. all of which he shews may be turned to great advantage in an economical point of view. He calculates, that slates may be substituted for tiles in roofing and flooring, with a saving of weight and expence—the weight of a 100 square feet of slate being 1 to 3 cwts. while that of single tiles is 7 cwts. The expence of the slates at Bombay would be 8 to 15 rupees per 100 sq. ft. cut and squared. There seems, however, a difference of opinion on the subject among those conversant with building; and it does not appear, that the best slates in Europe are much, if at all, lighter than the tiles used in this country. The slates would, like the Chunar stones used in our western provinces, admit of the beams being placed further apart, and of the burgars being dispensed with; and this alone, if the land carriage be not very heavy, will produce a demand for so useful and elegant a roofing material. The following is an extract from Captain Jervis's report on the subject, dated March, 1832.

“The above varieties of slate alternate with strata of the most beautiful descriptions of marble and porphyry; in the latter of which are found nodules of jasper, of considerable size, and those strata pass off into micaceous schist, hornblende, corundum, and trap, with a less distinct transition into alum-slate, and secondary limestone.

“The strata run nearly east and west, and exhibit all the characteristics of the primitive rocks to which they pertain, both in respect of their fracture, dip, and the absence of all vestiges of animal remains; so far as I have yet been able to examine them, a small portion of these valuable productions lie within the Honorable Company's district of Bajulkota; but nine-tenths, and those of the very finest quality, are in the territories of a number of independent jaghírdars and chieftains. The natives have no name for slate; are utterly ignorant of its nature, use, or the method of quarrying it; and after a most diligent search in every village, where I have traced it, I have not found a bit, so much as an inch square, in any wall, or building, or in any way whatever applied to the purposes of life. I shewed the native shop-keepers, in the presence of a number of people, its value as a writing material, which delighted and astonished them beyond measure; but from the native chieftains downward to the lowest individual, not one, though living on the very spot, was acquainted with its use or value. The chieftains are anxious that I should carry on my researches within their respective limits, as likely to be attended with great advantage to themselves and their people, as well as to the community at large. The finest description of roofing slate is at Lokapur, not in the Company's territory; but there are scarcely any two villages which have the same kinds of slates—some kinds are good for one, others for another, purpose. The districts in which these slates are found are most commodiously situated within a short distance of the confluence of the Gatparhá and



Kristna rivers, which latter flows through Rastea's, the Nizam's, the Nagpur Rajah's, and the Honorable Company's territories, into the bay of Bengal; in its way hence, it traverses the Kalkapur Rajah's and Satarah Rajah's territory, and the states of the Putwårdhans and other numerous jaghirs, independent of Government.

"The existence of these extensive beds of marble has hitherto been equally unknown and despised: as the several varieties are very hard, they are little sought after for building purposes, and I have scarcely met with twenty houses plastered, or even built with lime—to which at least it might be supposed the natives would have applied it where the marble abounds."

The existence of the slate, although but little worked, seems to have long since been pointed out by Mr. Thomas Marshall, Statistical Reporter to the Bombay Government, from whose report, dated Dharwar, 29th July, 1821, we take the following extract.

"The next most general rock is a bluish clay slate, which however never assumes the elevation of hills, but is seen to traverse a great part of the country on both sides of the Gatparba, in the direction of W. by N. and E by S. Its layers are almost exactly perpendicular to the surface of the earth. It plainly dips under the sand-stone hills—one of its softest quarries, near Kundargi, supplies the surrounding country with whet-stones; but they are of a very inferior quality. It is not uncommon for a few layers of this clay slate to pass suddenly into semi-transparent greyish-white felspar, which in a few yards resumes the colour and texture of the slate. Throughout, this slate is traversed by numerous most irregular veins, which have the appearance of having once been a liquid matter poured into transverse and curvilinear fissures, which run in all directions. The matter filling the veins seems a mixture of quartz and clay, and is much harder than the substance of the slate; very beautiful crystals of quartz are frequently found in it."

### X.—Progress of European Science.

#### THEORETICAL GEOLOGY.

Following up the design proposed in our notice, of the progress of Electrical Science, we seek the most concise, comprehensive, and authentic materials for our present review, in the annual addresses of the presidents of the Geological Society. These do not merely embrace the practical labours of the associates of the Society itself at home and abroad, in their examination of the earth's surface, the description of rocks, the order of strata, and the classification of the fossils of every formation; but they at the same time deliver what we may consider an orthodox judgment *ex cathedra*, upon the various theories which the most eminent authors of the day have promulgated to the world: such, in the present period, are—the remarks of Hæxchel upon the influence of Planetary perturbation on Geological phenomena; —Lyell's estimate of the effect of causes still in action, upon the past modifications of the earth's crust, and Elie de Beaumont's theory of the contemporaneous upheaving of parallel mountain ranges;—the temperature of the globe;—the connection of thermal springs with volcanic action;—the gradual transition of fossil species, and a multitude of other questions of the greatest interest to the geological theorist. Thus Geology has almost ceased to be the science of observation alone, as it was so long its boast to be called; and it now challenges a share in the physical speculations of the astronomer, the dynamical calculations of the mechanician, and the primeval chronology of the cosmogonist and historian. Upon the

First of these connections, the Rev. Professor SEDGWICK thus states the actual state of opinions.

"Some great and simple problems in physics have so immediate a connexion with the structure of the earth, that we may almost claim their solutions for our own.

"The form put on by a fluid body in rotation is an abstract question, which might or might not have any real application to the bodies of our solar system. But direct geodesic observations, as well as the relative position of land and water, prove that the stratified matter on the crust of the earth is deposited in near conformity to the surface of a true spheroid of rotation. Here then we have, in spite of one of the arbitrary dogmas of the Huttonian theory, an indication of a primeval fluidity before the commencement of any one phenomenon coming within the direct speculations of geology. And again, the direct phenomena of geology are in the strictest harmony with this conclusion. For, after passing through a few stages of stratified matter, formed by the degradation of matter in a prior state of solidity, we are conducted to other unstratified masses with that crystalline structure which implies an anterior fluidity—in some cases unequivocally, and in all cases probably, derived from the solvent power of heat.

"But if the earth ever existed in any state approaching to igneous fusion, it must have undergone a great diminution of temperature, before it was fitted for the habitation of any organized being. And here again geological facts are at least in a general accordance with the hypothesis; for the forms of the living beings, entombed among the ancient strata, not only seem to indicate a high temperature, but also a gradual refrigeration of the surface of the earth.

"Here however we meet with an unexpected difficulty. If during any period, the earth have undergone a sensible refrigeration, it must also have undergone a contraction of its dimensions; and also, as a necessary consequence of a well known mechanical law, an acceleration round its axis of rotation. But direct astronomical observations prove, that there has been no sensible diurnal acceleration during the last 2000 years; and therefore, by inverting the steps of the reasoning, we prove—that during that long period there has been no sensible diminution in the mean temperature of the earth. This difficulty does not, however, entirely upset the previous hypothesis: it only proves, that the earth had reached an equilibrium of mean temperature before the commencement of good astronomical observations.

"But if our speculations are thus limited and guided by the observations of astronomy, we have in part paid back to that exalted science the obligations we owe to it. The great bodies of our system leave behind them no marks to track their progress through the heavens; and the vast secular periods we can calculate, reaching to ages long anterior to the records of our being, might be mere fictions of the mind, which have never had any archetype in nature. But in the phenomena of geology, we are carried back, almost at our first step, to times unlimited by any narrow measures of our own; and we exhibit and arrange the monuments of former revolutions, requiring for their accomplishment perhaps all the secular periods of astronomy. Nor is this all. We show, by help of records, not to be misinterpreted, that during this vast lapse of time, in the very contemplation of which our minds become bewildered, the law of gravitation underwent no change, and the powers of atomic combination were still performing their office.

"If the phenomena of geology be coeval with long returning astronomical periods (and it is at least impossible to prove the contrary), a question may arise,

whether some of the first difficulties we meet with (such as those connected with the transport of diluvial gravel, and the gradual diminution of temperature) may not be attributed rather to effects of planetary perturbation than to any change in the internal condition of the earth. This question has been admirably discussed in a recent paper by Mr. Herschel.

"Of all the secular inequalities produced by perturbation, those of the moon alone can produce any visible effects upon the tidal level. The lunar inequalities considered are of two kinds—change of mean distance, and change of eccentricity. Both are confined within narrow determined limits; and Mr. Herschel shows, by actual calculation, that they could not have produced any of the great movements contemplated in geology.

"The planetary perturbations of the orbit of the earth are next considered, and the influences they may have produced on the diffusion of light and heat. The secular variation of obliquity is too small to have ever caused any sensible effect on our climates: but he proves, by direct calculation, that the mean annual diffusion of solar light and heat varies inversely as the minor axis of the orbit; or, in other words, increases or diminishes with the increase or diminution of eccentricity. Now, as a matter of fact, the eccentricity of the earth's orbit has been for many ages slowly diminishing, and is now very small; but the limits of its secular variation have not yet been calculated. He assumes, therefore, hypothetically, that the eccentricity of our orbit *may* once have been as great as that of some of the inferior and superior planets; and on that supposition, he proves, that the slow diminution of eccentricity *may* have produced a gradual change of climate, of the very kind indicated by geological phenomena.

"Into the solution of the great problem of the heavenly bodies, there enter only a few simple and unchangeable mechanical elements, and the conclusions are of a simplicity corresponding to the simplicity of the premises. All the celestial movements return into themselves; and even the most complex of the deviations produced by mutual perturbation, are confined within narrow limits, and are completed in secular periods. The solution of this problem is incontestably the greatest triumph of exact science. But with what semblance of physical truth can we apply such mathematical results as these to the great phenomena of geology—where the combinations are mutable and indefinite—where we have no vestige of returning periods—and where the fixed elements of force are either unknown or imperfectly comprehended?

If all the complex groups of crystalline and stratified rocks; if, in a word, all the material things existing on the surface of the globe, be bound to each other by laws like those which govern the movements of the heavenly bodies—*then every material combination we now see must re-appear with all its complicated relations after the lapse of some long period of time.* But would not such a supposition be now regarded as the mere wantonness of hypothetical extravagance? And let it not be said, that it is only in the greater combinations on the surface of the earth that we are to look for returning cycles. Great and small have no meaning, except in reference to us and our conceptions. The earth is an atom in comparison with the visible creation; and all we now behold may be but as an atom in comparison of that which is unseen; and the meanest combinations of material things submitted to our senses propagate their influence through all space co-extensive with gravitation, and play their part in keeping up the stability of the universe.

To the supreme Intelligence, indeed, all the complex and mutable combinations we behold, may be but the necessary results of some simple law, regulating every ma-

terial change, and involving within itself the very complications, which we, in our ignorance, regard as interruptions in the continuity of Nature's work. In contemplations of this kind, our understanding is lost among the stern doctrines of philosophical necessity. But, as far as regards us and our faculties, there is no such thing on earth as undeviating moral or physical necessity. For as, in morals, necessity is made, in part, at least, subordinate to the freedom of human will, so, in physics, the continued action of immutable causes may and does co-exist with mutable phenomena.

"The study of the great physical mutations on the surface of the earth is the business of geology. But who can define the limits of these mutations? They have been drawn by the hand of Nature, and may be studied in the record of her works—but they never have been, and never will be fixed, by any guesses of our own, or by any trains of *à priori* reasoning, based upon hypothetical analogies. We must banish all *à priori* reasoning from the threshold of our argument; and the language of theory can never fall from our lips with any grace or fitness, unless it appear as the simple enunciation of those general facts, with which, by observation alone, we have at length become acquainted."

The above observations are introductory to the Professor's objections to Mr. Lyell's system of "geological dynamics," which, although highly praised, as a new province of the science studied with immense research, and pregnant with facts necessary to be borne in mind, in the explanation of every observed phenomenon, seems to him to have been strained beyond the limits of logical inference, in its application to the vast efforts of displacement and deposition, of the gigantic epoch of geology.

"Mr. Lyell appears not only as the historian of the natural world, but as the champion of a great leading doctrine of the Huttonian hypothesis; in the language of an advocate, he sometimes forgets the character of an historian. In reading his graphic and eloquent descriptions of the mighty works of degradation yearly going on through the eastern shores of England, or of the enormous weight of solid matter hourly rolled down by the Ganges\* or the Mississippi, I have fancied, that the earth was sliding from under my feet, and that it would soon pass away, like the sand of an hour-glass, beneath the waters of the ocean.

"But are there no antagonist powers in nature to oppose these mighty ravages—no conservative principle to meet this vast destructive agency? The forces of degradation very often of themselves produce their own limitation. The mountain torrent may tear up the solid rock, and bear its fragments to the plain below; but there its power is at an end, and the rolled fragments are left behind to a new action of material elements. And what is true of a single rock is true of a mountain chain; and vast regions on the surface of the earth, now only the monuments of spoliation and waste, may hereafter rest secure under the defence of a thick vegetable covering, and become a new scene of life and animation.

"It well deserves remark; that the destructive powers of nature act only upon lines, while some of the grand principles of conservation act upon the whole surface of the land. By the processes of vegetable life, an incalculable mass of solid matter is absorbed, year after year, from the elastic and non-elastic fluids circulating round the earth, and is then thrown down upon its surface. In this single operation, there is a vast counterpoise to all the agents of destruction. And the deltas of the Ganges and the Mississippi are not solely formed at the expense of the

\* For a correction of the estimate of Major Rennell, see the pages of this Journal and of the GLEANINGS.

solid materials of our globe, but in part, and I believe also in a considerable part, by one of the great conservative operations by which the elements are made to return into themselves.

"According to the principles of Mr. Lyell, the physical operations now going on are not only the type, but the measure of intensity of the physical powers acting on the earth at all anterior periods: and all we now see around us is only the last link in the great chain of phenomena, arising out of a uniform causation, of which we can trace no beginning, and of which we see no prospect of the end. And in all this, there is much that is beautiful and true. For we all allow, that the primary laws of nature are immutable—that all we now see is subordinate to those immutable laws—and that we can only judge of effects which are past, by the effects we behold in progress. Whether there be, or be not, any physical traces of a state of things anterior to the commencement of our geological series of deposits, is a question of no real importance. But to assume, that the secondary combinations, arising out of the primary laws of matter, have been the same in all periods of the earth, is, I repeat, an unwarrantable hypothesis with no *a priori* probability, and only to be maintained by an appeal to geological phenomena.

"Each formation of geology may have required a very long period for its complete development; and of such an element as past time, we grudge no man the appropriation. But after all, the successive formations, about which we speculate, however complex in their subdivisions, are small in number: and after decyphering a series of monuments, we reach the dark ages of our history, when, having no longer any characters to guide us, we may indulge at will in the creations of our fancy. We may imagine indefinite cycles, and an indefinite succession of phenomena; and in the physical world, as well as in the moral, we may have our long periods of fabulous history. But these things belong not to inductive geology; and all I now contend for, is—that in the well established facts brought to light by our investigations, there is no such thing as an indefinite succession of phenomena.

"If the principles vindicated in Mr. Lyell's work be true, then there can be no great violations of continuity, either in the structure or position of our successive formations. But we know, that there are enormous violations of geological continuity; and though, relatively speaking, many of them may be local, of this at least we are certain, that they have been produced by forces adequate to the effects, and co-extensive with the phenomena.

"The very first step we take, we see a violation of continuity. Between the alluvial silt, deposited by the waters now flowing off from the inequalities of the earth, and the masses of diluvial gravel scattered over so many parts of its surface, we can seldom establish any appearance of continuity, or give any intelligible proof of their common origin. I am not going now to plunge into this long debated question; but I may remind you of the enormous waterworn blocks (derived from the primary clains to the north of the Baltic Sea), which lie scattered over the great European plain, extending from the eastern states of Holland to the Steppes of central Russia. Where are the inclined planes down which these boulders could have descended? Where are the grooves and channels cut out by the rivers which once propelled them? Where is the alluvial silt accumulated by the erosion of these ideal waters? No answer can be given to these questions; and to talk of river action, aided as it may have been by every ordinary power of nature, appears to me, in a case like this, little better than a mockery of my senses."

"If indeed we were to admit a period of intense volcanic violence, and a sudden elevation of the Scandinavian chain, we might then have a cause commensurate to the effects observed, and in the rush of the retiring waters, we might explain the transport of those great boulders which lie scattered over the northern plains of Europe. But in the speculations I am combating, all great epochs of elevation are systematically, and I think unfortunately, excluded. Volcanic action is essentially paroxysmal; yet Mr. Lyell will admit no greater paroxysms than we ourselves have witnessed—no periods of feverish spasmodic energy, during which the very frame-work of nature has been convulsed and torn asunder. The utmost movements that he allows are a slight quivering of her muscular integuments."

These objections to Mr. Lyell's theory are perhaps carried too far: he does not insist upon the absence of all violent paroxysms, so much as he labours to give due weight to the power of causes now in operation. The existence of a vast depression on the earth's surface, extending beyond the Caspian and the Aral, might be adduced as an illustration of great operations still working before our eyes; should any fissure be laid open by subterranean force, so as to connect this basin with the nearest ocean, we should suddenly witness a deluge, attended with proportionate convulsions, over a space ascertained by M. de Humboldt and Col. Monteith to extend over at least 18000 square leagues, reaching to Saratof Orenburg, and the low regions of the Oxus and the Jaxartes: the lowest level of this vast basin is 300 feet below the Mediterranean\*.

Mr. R. J. Murchison, the present President of the Geological Society†, was a fellow labourer with Mr. Lyell, when his mind was first led to the line of investigation which he has since developed. It was in their tour along the southern shores of the Mediterranean, and subsequently in the north of Italy, that Mr. Lyell's attention was particularly directed to the distribution of the tertiary strata into new groups, according to the proportional number of shells identical with living species, found fossil in each formation: after examining the Sub-Apennine shells, he pursued his inquiries in Naples and Sicily, where disturbing causes have been in continual action from remote antiquity, hoping to ascertain whether successive and distinct creations of organic remains might not have been elevated from beneath the sea, by a series of subterranean convulsions, continued from the period of the mixed Sub-Apennine deposits, uninterruptedly, to the historic æra. He here began to unfold the true papyri of geological history: in many mountains of considerable magnitude, the extinct species had nearly disappeared, and in other vast accumulations of fossil marine shells, nearly all were specifically identical with those now inhabiting the adjoining sea. Thus, by a series of deductions, he removed as arbitrary and untrue those lines of demarcation between what had termed the ancient and the existing orders of nature; and he had the satisfaction to find, that the same train had been developed by M. Desnoyers and M. Deshayes, from a close examination of the Paris basin.

\* Professor Murchison's Address, 1832, *Phil. Mag.* lxx. p. 384.—*Gl. in Sc.* III. 330. The Academy of St. Petersburg, at the instigation of M. de Humboldt, is now engaged in directing surveys and barometrical "soundings," as they are emphatically styled, by which the precise extent, depths, and true shore of this dry Caspian will be accurately defined.

† Annual Address, 1832, *Phil. Mag.* lxx. 375.

Mr. Lyell has engaged the latter to co-operate with him in classing the tertiary formations chronologically, according to the relative number of existing species in each group. Their joint labours will form a most valuable "Manual of Fossil Conchology," which is announced as forthcoming in the third volume of Mr. Lyell's "Principles of Geology." It was subsequent to these states that the latter author was prompted to continue his examination of the various causes still in operation on the surface of the globe, which form the subject of his second volume. In the former, we were presented with the effects of monstrosities; in the second, we find an abundance of facts connected with the fluctuations in the organic world. So ample are the data in natural history, upon which the author has established his conclusions, that they cannot fail to relieve him from the charge of visionary speculation\*.

Prof. Sedgwick felt alarmed, lest the gradual course of nature, upheld in the first volume, should favor the doctrine of spontaneous generation and transmutation of species, with all their train of monstrous consequences; but nothing can be fairer or more impartial than the manner in which the untenable parts of Lamarck's dogmas are refuted in the second volume, and the recent appearance of man upon our planet, satisfactorily confirmed.

Turning now from the view of gradual changes, upon which we have impartially quoted the opinions of an opponent and of an advocate, we come to the hypothesis of mundane convulsions, where, as might be expected, the late and the actual Presidents change sides. In the words of the former, the theory of M. Elie de Beaumont is thus described†:

"M. Elie de Beaumont, by an incredible number of well conducted observations of his own, combined with the best attested facts recorded by other observers, has proved, that whole mountain chains have been elevated at one geological period—that great physical regions have partaken of the same movement at the same time—and that these paroxysms of elevatory force have come into action at many successive periods. Distinguished as are his merits, he so far claims not an undivided honour. But in the next great step of generalization, he reaches a position where he stands entirely by himself.

"Step by step, we had been advancing towards the conclusion—that different mountain chains had been elevated at several distinct geological periods; and by a long series of independent observations, Humboldt, Von Buch, and other great physical geographers, had proved—that the mountain chains of Europe might be separated into three or four distinct systems; distinguished from each other, if I may so express myself, by a particular physiognomy, and, above all, by the different angles made by the bearings of their component formations with any assumed meridian. All the subordinate parts of any one system were shown to be parallel; while the different systems were inclined at various angles to each other.

"By an unlooked-for and most felicitous generalization, M. Elie de Beaumont has now proved, that these two great classes of facts are commensurate to each other; and that each of these great systems of mountain chains, marked on the map of Europe, by given parallel lines of direction, has also a given period of elevation, limited and defined by direct geological observations. The steps by which he reaches this noble generalization are so clear and convincing, as to be little short of physical demonstration. It forms an epoch in the history of our science; and I am using no terms of exaggeration when I say, that in reading the admirable researches of M. de Beaumont, I appeared to myself, page after page, to be ac-

\* Phil. Mag. 377.

† Anniversary Address, 1831.

quiring a new geological sense, and a new faculty of induction ; and I cannot express my feelings of regret, that during my recent visit to the Eastern Alps I did not possess this grand key to the mysteries of nature.

"I am aware how impossible it is in a few words to give any clear notion of a volume of condensed original researches. Dropping all minor details, I may, however, claim your indulgence, while I point out the author's manner of induction in four great systems of European chains : not indeed in the wish of quenching the curiosity of those who have not studied this question, but rather in the hope of urging them to seek the fountain of original information.

"1. The first system includes the higher elevations, in eastern France, of the Côte d'Or and Mont Pilas, and a portion of the Jura chain. It may be traced towards the valley of the Rhine, where it is suddenly cut off ; but it re-appears in the chain of the Erzgebirge, between Bohemia and Saxony. It never rises into mountains of the first order, but is marked throughout (as may be seen on a good physical map) by many longitudinal ridges and furrows, ranging nearly parallel to each other, in a direction about north-east and south-west. So far the statement is only an enumeration of certain connected facts in physical geography. But it is followed by a co-ordinate series of geological phenomena.

"A number of formations, including in the ascending order the whole oolitic series, enter here and there into the composition of the geographical system above described ; and without exception, wherever they appear, all are in turn elevated, broken, or contorted ; yet in their lines of range they preserve a parallelism to the general direction of the ridges. On the contrary, wherever rocks, of an age not older than that of the green-sand or chalk, appear in the vicinity of any portion of this system, they are either found at a dead level, and expanded from the neighbouring mountains into horizontal planes, like the sea at the base of a lofty cliff ; or if, since their first deposit, they have undergone any great movement, it is shown to have no relation to the bearing of the older ridges, and to have been produced at a later period.

"From all these combined facts follow three important consequences : 1st. That the whole system of parallel ridges, from one end to the other, was elevated at the same period of time, after the development of the oolitic series, and before the deposition of the green-sand and chalk. 2ndly. That the action of elevation was violent, and of short continuance ; for the inclined strata are shattered and contorted, and between them and the horizontal strata there is no intermediate gradation of deposits. 3rdly. That the period of elevation was followed by an immediate change in many of the forms of organic life.

"2. The next great system includes the whole chain of the Pyrenees—the Northern Apennines—the calcareous chains to the north-east of the Adriatic—nearly the whole Carpathian chain—and a great series of inequalities, continued from that chain through the Hartz mountains, to the plains of Northern Germany. Through the whole of these vast regions the principal inequalities range nearly parallel to each other, and have a mean bearing about west-north-west and east-south-east. So far again the statement is purely geographical, and its truth is seen at once in glancing over any good physical map of Europe ; and will be still more clearly comprehended, by comparing some of the principal ranges of colour on Von Buch's great geological map with the bearing of the Pyrenees. But it is followed by a series of co-extensive geological phenomena.

"Through all parts of this great system, formations of the age of the green-sand and chalk have had an enormous development, and without exception, their strata



are ruptured and contorted, and often lifted up to the very pinnacles of the mountains. But, on the contrary, wherever any tertiary formations approach the confines of this system, they are stated to be either in a position almost as horizontal as the surface of the waters in which they were deposited; or if they have been moved at all, it is by forces uninfluenced by the parallels of the older chains. And the same three conclusions, with a mere difference of dates, follow here as in the former case. All the great parallel ridges and chains of this second system must have been suddenly and violently elevated, and at a period of time between the deposition of the chalk and the commencement of the tertiary groups; and the corresponding change in organic types is, in this instance, still more striking than in the former.

"3. The third system embraces a great number of parallel inequalities, heaving about north-north-east and west-south-west, and includes the whole Western Alps, from the neighbourhood of Marseilles to the volcanic ridges near the foot of the Lake of Constance. And by an hypothetical, but I think probable extension, it also takes in the whole of the great Scandinavian chain.

"I cannot enter on the elaborate and satisfactory details by which it is proved—that all these great parallel inequalities in the region of the Western Alps had their origin after the tertiary *molasse*, a deposit partaking of all the elevations and contortions of the older strata—that the elevatory movements were sudden and violent, and commenced at a time when tribes of mammalia (the remains of which in England are hardly ever found except in the superficial gravel) flourished in many parts of Europe—and that these movements were immediately succeeded by great horizontal deposits of old diluvial gravel at the base of the Western Alps, and probably also by that vast outshot of Scandinavian rocks which lie scattered over the northern plains of Germany.

"4. The fourth system embraces many great parallel ridges, having a range about east-north-east and west-south-west, and includes several considerable chains in Provence, and nearly the whole chain of the Eastern Alps—from the great flexure in the region of Mont Blanc to the Alps of the states of Austria.

"It would be impossible to follow the author through details occupying a large portion of his volume. I may however state, that he proves the formations of the Eastern and Western Alps not to pass into each other by any flexure of the strata, coinciding with the bend of the whole chain; but to meet at an angle marked by a great double system of breaks and fissures, one passing in the direction of the eastern, and the other of the western, portions of the chain. He further proves, that the system of fissures in the line of the Eastern Alps is more recent than the other system—that in the prolongation of this line, towards the west, the old diluvial gravel has undergone movements of elevation—and that these movements have been propagated to the lacustrine and volcanic regions of Auvergne.

"On a review of the whole evidence, I think he has demonstrated, that there are two distinct deposits of diluvial gravel near a portion of the Western Alps—that the colossal mass of Mont Blanc, and at least a considerable portion of the Eastern Alps, were elevated after the deposit of the older diluvium—and that the newer diluvium (including all those enormous crystalline erratic blocks so admirably described by Sanssoucy) rolled off from the regions of the higher Alps during this last period of their elevation.

"There are six other supposed periods of elevation briefly considered in the researches of M. Elie de Beaumont, each marked by distinct geographical features: but I will not now detain you with their enumeration. If the generalizations to

which I have pointed be true, (and as far as I comprehend them, they seem to be based on an immovable mass of evidence,) we must then conclude that there have been in the history of the earth long periods of comparative repose, during which the sedimentary deposits went on in regular continuity, and comparatively short periods of violence and revolution, during which that continuity was broken. And if we admit, that the higher regions of the globe have been raised from the sea by any modification of volcanic force, we must then also admit that there have been several successive periods of extraordinary volcanic energy.

"How we are to escape from this conclusion I am unable to comprehend, unless we shut out the evidence of our senses. Of volcanic powers we know nothing, except during the irregular periods of their activity—and returning periods of intense activity, after long ages of comparative repose, may be among the enduring principles in the mechanism of nature. I do not throw this out as even a probable hypothesis : but it is, at least, as probable as any other hypothesis unfounded on the evidence of geological phenomena.

"That the system of M. Elie de Beaumont is directly opposed to a fundamental principle, vindicated by Mr. Lyell, cannot admit of doubt. And I have decided to the best of my judgement, in favour of the former author, because his conclusions are not based upon any *a priori* reasoning, but on the evidence of facts ; and also, because, in part, they are in accordance with my own observations\*."

Mr. Boué and other able writers have opposed the views of this eminent geologist ; they deny him the merit of being the first to point out, that different formations and masses of land have been elevated at distant and separate periods, and reject that part of his system which asserts the synchronous elevation of distant mountain chains parallel to each other. Before we are warranted in arriving at general conclusions on this latter point, numerous facts must be collected, and we can but urge all our working brethren to try the adequacy of M. de Beaumont's ingenious theory, by an appeal to nature† ; M. de Humboldt believes, that the four great chains of Asiatic mountains are parallel to one another, and that circumstance tends powerfully to confirm the theory. As however, the personal observations of this traveller have not extended beyond the Altai, we must still look for evidence whereon the synchronism of the elevations of these mountains may rest to our Indian geologists, whose exertions will naturally be stimulated to attempt the solution of the problem. Russia has been before hand with us in exploring their newly acquired portion of Asia ; their government, with its characteristic enterprize, being desirous of acquiring accurate information respecting the structure, natural history, and heights of the Caucasus, sent hither in the summer of 1829, under a strong escort, commanded by General Emanuel, a party of men of science, the chief of whom, M. Kupfer, has given in his report to the Academy of Sciences of St. Petersburg.

\* "For example, the vertical position of the green-sand and chalk on the eastern flank of the Hartz mountains, and the horizontal position of the same formations on the flanks of the Erzgebirge, were remarked by Mr. Murchison and myself, in the summer of 1829. During the same tour, we had repeated proofs of the recent elevation of the chain of the Eastern Alps ; of the high elevation of the green-sand series in the calcareous chain to the north-east of Trieste : and of the horizontality of the tertiary deposits of Styria. All these facts (of which we did not at the time comprehend the whole importance), harmonize with the system of M. de Beaumont."

† Address, 383.

From the geographical and geological chapters of this interesting report, we learn, that the low hills, which rise above the Steppes of the Black Sea and Sea of Azof, are composed of limestone, filled with littoral shells, the collections of which made by M. Pander, on this and a former occasion, must prove of great geological importance. On ascending from the Steppes towards the Caucasus, grits and older limestones, with ammonites, occupy an undulating country, diversified by several peaks of trachyte, the principal of which, the *Bechtay*, or five mountains, is stated to be 4000 feet above the sea. The outer zone of the Caucasus is described as being a rugged and lofty plateau from 8000 to 9000 feet above the sea, the strata of which present tabular summits, chiefly composed of calcareous grit and conglomerates nearly horizontal, or rising at only a gentle angle towards the central ridge. This table land is figured by deep transverse rents, in which the rivers flow; and one of the lowest formations is a limestone, which the author compares with the *calcaire à graphites*. These secondary strata are separated from the central mountains by a band of transition and old slaty rocks, which have been dislocated by the contact of certain green stones and basalts. The loftiest part of the central chain, culminating in the double peak of Mount Elborz, at the height of 15,100 French feet above the Black Sea, is entirely of igneous origin, being principally composed of a dark-coloured porphyritic trachyte. The volcanic rocks of this region are shown to be of considerable antiquity, because the secondary deposits rest upon them in undisturbed positions, the transition formations having alone been dislocated\*.

It did not come within our purpose to particularize any practical geological researches, but we have digressed in this case, because the ground trodden is closely connected with our own Asiatic field, and it may act as an useful stimulus to point out what our neighbours are about. The Court of Directors have appointed to Madras an eminent geologist, Dr. Turnbull Christie†, of whose researches in Sicily, the President of the Geological Society speaks in high terms; to him, we look with great expectation, when he enters the vast field, hitherto but partially visited by Voyageur and Dangerfield.

But to continue our review of Theoretical Geology:—the phenomena of *thermal springs* have been attributed by Dr. Daubeny to volcanic agency, whether they issue from the neighbourhood of action and extinct foci of eruption, or upon linear fissures and dislocations of the ancient strata, produced by expansive forces during former periods of elevation; in fact, the evolution of gases and increased temperature of springs may be looked upon as proofs of the presence of volcanic action still in force, with as much propriety as eruptions of lava and shocks of earthquakes. Having detected the presence of nitrogen gas in thermal waters, he concludes, that the chemical theory of the origin of volcanoes is still to be maintained, as being more philosophical, and more consistent with facts and experiments, than the hypothesis of a central ignited fluid, which has been from time to time mechanically forced up to the surface of the earth.

The question of the increase of the temperature of the ground, in descending to great depths, still rests upon uncertain data. As far as experiments upon mines and artesian springs have been carried (by M. Cordier in particular), the results

\* Murchison's Address, Phil. Mag. lxx. 385.

† Since the above was written the death of this meritorious and able officer has been announced! He was on his way to the Nilgiri Hills, which he proposed to explore with care, where he was attacked by jungle fever to which he fell a victim in a few days.

are uniformly favorable to such a theory—on the sea they are as steadily opposed to it; observations of the temperature of springs in all parts of the world are invited to solve this question\*.

It is now generally acknowledged, that the formation called *diluvial gravel*, and supposed to have reference to the epoch of the deluge, is not the result of one, but of many successive periods. The essays of M. Beaumont have established this point beyond dispute, although it militates against opinions, but a few years since held almost universally as indisputable.

"We now connect the gravel of the plains with the elevation of the nearest system of mountains; we believe that the Scandinavian boulders in the north of Germany are of an older date than the diluvium of the Danube; and we can prove that the great erratic blocks, derived from the granite of Mount Blanc, are of a more recent origin than the old gravel in the tributary valleys of the Rhone.

"Theories of diluvial gravel, like all other ardent generalizations of an advancing science, must ever be regarded but as shifting hypotheses to be modified by every new fact, till at length they become accordant with all the phenomena of nature.

"In retreating where we have advanced too far, there is neither compromise of dignity nor loss of strength; for in doing this, we partake but of the common fortune of every one who enters on a field of investigation like our own. All the noble generalizations of Cuvier, and all the beautiful discoveries of Buckland, as far as they are the results of fair induction, will ever remain unshaken by the progress of discovery. It is only to theoretical opinions that my remarks have any application.

"Different formations of solid rock, however elevated and contorted, can never become entirely mixed together; and the very progress of degradation commonly lays bare all the elements of their structure. But diluvial gravel may be shot off from the flanks of a mountain chain, during one period of elevation, and become so confounded with the detritus of another period, that no power on earth can separate them: and every subsequent movement, whether produced by land floods or any other similar cause, must continually tend still further to mingle and confound them. The study of diluvial gravel is, then, not only one of great interest, but of peculiar difficulty and nice discrimination; and in the very same deposit, we may find the remains of animals which have lived during different epochs in the history of the earth.

"Bearing upon this difficult question, there is, I think, one great negative conclusion now incontestably established—that the vast masses of diluvial gravel, scattered almost over the surface of the earth, do not belong to one violent and transitory period. It was indeed a most unwarranted conclusion, when we assumed the contemporaneity of all the superficial gravel on the earth. We saw the clearest traces of diluvial action, and we had, in the Mosaic history, the record of a general deluge. On this double testimony it was, that we gave a unity to a vast

\* The prevailing practice of boring for water affords an easy method of ascertaining the temperature of the ground of different depths, free from the dubious results of mines!—thus Magnus has found from borings near Berlin, the temperature of the air being 49° 1' the heat of the ground was as follows:

|              |                   |                                   |
|--------------|-------------------|-----------------------------------|
| at 675 feet, | temperature 67.7, | giving for one degree, 36.3 feet. |
| 516 do.      | 63.9,             | 34.7 do.                          |
| 392 do.      | 62.8,             | 28.5 do.                          |

succession of phenomena, not one of which we perfectly comprehended, and under the name diluvium, classed them all together.

"To seek the light of physical truth by reasoning of this kind, is, in the language of Bacon, to seek the living among the dead, and will ever end in erroneous induction. Our errors were, however, natural, and of the same kind which led many excellent observers of a former century to refer all the secondary formations of geology to the Noachian deluge. Having been myself a believer, and, to the best of my power, a propagator of what I now regard as a philosophic heresy, and having more than once been quoted for opinions I do not now maintain, I think it right, as one of my last acts before I quit this chair, thus publicly to read my recantation.

"We ought, indeed, to have paused before we first adopted the diluvian theory, and referred all our old superficial gravel to the action of the Mosac flood. For of man, and the works of his hands, we have not yet found a single trace among the remnants of a former world entombed in these ancient deposits. In classing together distant unknown formations under one name; in giving them a simultaneous origin, and in determining their date, not by the organic remains we had discovered, but by those we expected hypothetically hereafter to discover, in them; we have given one more example of the passion with which the mind fastens upon general conclusions, and of the readiness with which it leaves the consideration of unconnected truths.

"Are then the facts of our science opposed to the sacred records? and do we deny the reality of a historic deluge? I utterly reject such an inference. Moral and physical truth may partake of a common essence, but as far as we are concerned their foundations are independent, and have not one common element. And in the narrations of a great fatal catastrophe, handed down to us, not in our sacred books only, but in the traditions of all nations, there is not a word to justify us in looking to any mere physical monuments as the intelligible records of that event: such monuments, at least, have not yet been found, and it is not perhaps intended that they ever should be found. If however, we should hereafter discover the skeletons of ancient tribes, and the works of ancient art buried in the superficial detritus of any large region of the earth; then, and not till then, we may speculate about their stature, and their manners, and their numbers, as we now speculate among the dis-interred ruins of an ancient city\*."

After learning, that so important a change has been effected in the nomenclature of geological formations, we cannot conclude the present compilation better than by presenting our readers with a comparative view of the classification of rocks, according to all the current systems, extracted from the excellent Manual of Geology recently published by Mr. De la Beche, a work which compresses into the most portable form the whole data of Geological Science, and on which Mr. Murchison passes the following encomium:

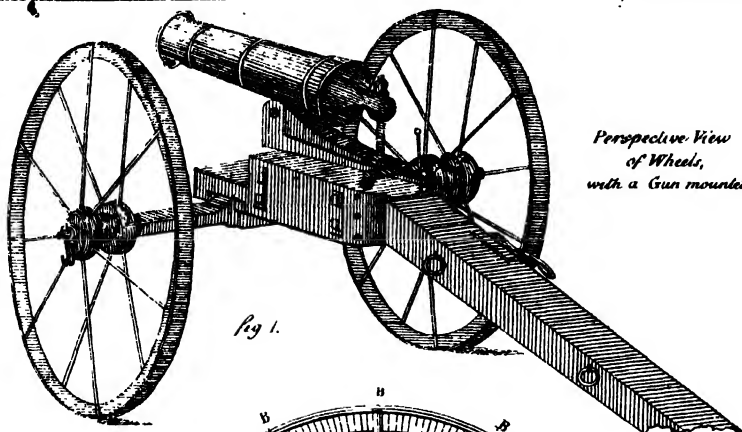
"Nothing short of this compendious and instructive digest, in which without losing sight of general principles the author has endeavoured to adhere to the impartial rule of *suum cuique* was to have been expected from the pen of so experienced and acute a geologist; and so eager in the demand of the public for a really good work on this subject, that a second edition has been called for, and is already published†."

\* Rev. Prof. Sedgwick's Address. Phil. Mag. 314.

† Murchison's Address, Phil. Mag. lxx. 374.

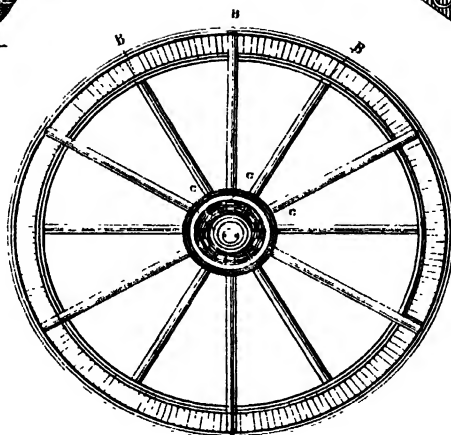
|                     | De la Beche.  | Detritus of various kinds produced by causes now in action; Travertino, &c.   | Improved-Wernerian.  | Conybeare.                          | Omalius & Halloy, 1830.          | Brongniart, 1829.   |                   |
|---------------------|---|---|--|-------------------------------------|----------------------------------|---|-------------------|
| STRATIFIED ROCKS.   | 1. Modern Group.                                      |   | Alluvion..   | .....                               | .....                            | Alluvial and Lysian rocks.  | Jovian Period.    |
|                     | 2. Erratic Block Group.                               | Transported boulders and blocks; gravels on hills and plains, apparently produced by greater forces than those now in action.   | Diluvium: Ancient Alluvion.  | Superior Order.                     | Tertiary rocks.                  | Clysmian rocks.   |                   |
|                     | 3. Supercretaceous Group.                             | Various deposits above the chalk, such as, in England, the Crag, Isle of Wight beds, London and Plastic clays. In France, the freshwater and marine rocks of Paris, &c.   | Tertiary..   | .....                               | .....                            |   | Secondary.        |
|                     | 4. Cretaceous Group.                                  | 1. Chalk. 2. Upper green-sand. 3. Gault. 4. Lower green-sand. To which may be added, for convenience, 1. Weald clay. 2. Hastings sands. 3. Purbeck beds.                  |  |                                     |                                  |   |                   |
|                     | 5. Oolitic Group.                                     | The rocks usually known as the Oolite formation, including the Lias.  | Secondary  | Super-medial Order.                 | Ammonian rocks.                  | Izemian rocks.  |                   |
|                     | 6. Red Sandstone Group.                               | 1. Variegated or Red marl. 2. Muschelkalk. 3. Red sandstone. 4. Zechstein; and 5. Red conglomerate.   |  |                                     |                                  |   |                   |
|                     | 7. Carboniferous Group.                               | 1. Coal measures. 2. Carboniferous limestone. 3. Old red sandstone.   |  | Medial.                             | .....                            |   | Saturnian Period. |
|                     | 8. Grauwacke Group.                                   | Grauwacke, thick-bedded and schistose, sometimes red; Grauwacke limestones; Grauwacke clay slates, &c.  | Transition....   | Sub-medial Order.                   | Hemilysonian rocks.              | Hemilysonian rocks.   |                   |
|                     | 9. Lowest Fossiliferous Group.                        | Various slates, frequently mixed with stratified compounds resembling those of the unstratified rocks.  |  |                                     |                                  |   |                   |
|                     | INFERIOR STRATIFIED, OR NON-FOSSILIFEROUS.            | No determinate order of superposition. . . . .  | Primitive, or Primary....  | Inferior Order.                     | .....                            | Agalysonian rocks.  | Primordial.       |
| UNSTRATIFIED ROCKS. | Volcanic, Trappian, Serpentinous, and Granitic rocks. | Ancient and modern Lava, Trachyte, Basalt, Green-stone, Cornucans, Augite & Hornblende Porphyries, Serpentine, Diabase rock, Sienite, Quarziferous Porphyry, Granite, &c. | Arranged among the stratified rocks, according to the order in which they are supposed to occur. | The same as the improved Wernerian. | Pyroclastic & Agalysonian rocks. | Modern volcanic rocks, classed as pyrogenous rocks; igneous rocks of an older date, as Typhonian. |                   |





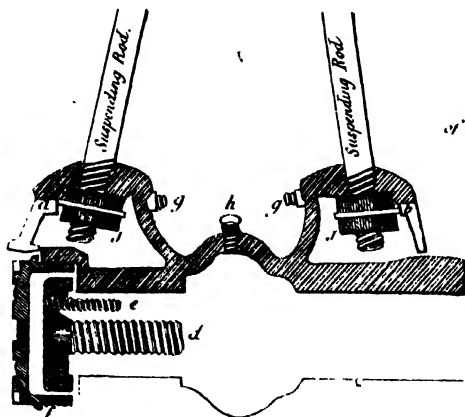
Perspective View  
of Wheels,  
with a Gun mounted.

Fig. 1.



Front View  
with  
the Shield of the Nave.

Fig. 2.



Section  
of the Nave.

Fig. 3.



## XI.—PROGRESS OF MECHANICAL SCIENCE.

### 2. *Iron Suspension Wheels.*

[Note accompanying the model presented to the Asiatic Society, by Lieut.-Colonel Watson, 3rd Oct.]

A description of the great improvement in the construction and principle of wheels for carriages of all sorts lately introduced by Mr. Theodore Jones, will be found in most of the journals of mechanical inventions at home; but as such works are not frequently to be met with in India, I will commence by explaining the nature of this invention in the words of a small pamphlet, published by the patentee, referring the reader to the accompanying plate in explanation, or those who are in Calcutta, to the model deposited in the rooms of the Asiatic Society.

"The construction of Messrs. Jones & Co.'s wheels is upon a new principle, that of suspension. In the old wheels, those spokes, which are under the nave, support the weight; in these it is jointly sustained by rods depending from the upper part of the felloe, as will be seen in the plate, fig. 1. The rod or spoke is made thick at the outer end, so as to be drawn firmly into a conical hole, bored from the outside of the felloe, and the nave depends from the rods, being sustained by nuts and screws within the cells, fig. 2. The advantage of this principle is, that it gives an elasticity to the lower part of the periphery of the wheel, which, while it diminishes the draught, is less wear to the road.

An aperture, in which there is a thumbscrew, is made into the centre of the nave, where the oil cell is, and by which it is replenished, without taking the wheel off the axle. The cell contains enough oil to serve the wheel in work for five or six weeks.

The Patent wrought-iron wheels are made either cylindrical, conical, or dish-like, and are either sold with the improved axles, or may be fitted to any others.

Fig. 1 of the accompanying plate exhibits a perspective view of the wheels applied to a gun-carriage. Fig. 2 is an elevation of the same, with the ring of the nave open, to show the nuts of the suspension bars: their construction is more fully shewn in fig. 3 wherein *a*, *b*, are the front and back shields; *c*, a collet on the end of the axle; *d*, a screw with conical head, which passes through the collet, and fastens it to the axle; *e*, a small screw through the side of *d*; *f*, a collar on the cap, which presses against a leather-washer, to prevent the oil escaping in front; *gg*, small bolts, which keep the shields in their places; *h*, a thumb-screw, where oil is to be supplied; *jj*, the nuts which are screwed on the end of the rods (or spokes) in the nave. The cap (in front of the nave) must be taken off, when the wheel is to be put upon the axle, in order to fasten the *collet* in its place, which is a substitute for a lynch-pin.

If the suspending rods of the wheels by any means become slack, each of the nuts must be screwed up (equally), which is done better by giving the head of the rod a blow with a hammer, and turning the nut at the same instant, taking care when done, that each nut presents one of its flat sides in front for the shield to press against, which will prevent the nuts unscrewing."

I shall beg leave now to offer a few remarks on the appearance, durability, strength, efficiency, and comparative economy of the suspension wheels, and to publish, for the satisfaction of those, who wisely wait for the actual trial of an invention, before determining in its favor, the result of some experiments made by order of the Court of Directors, who have in consequence determined on a more extensive trial of the wheels by their ordnance department in India.

The iron wheel, though the same weight, or lighter than the common one in use, is incomparably lighter and more elegant in appearance: to give sufficient strength to wooden wheels, particularly in this country, they require to be made proportionally clumsy; this is particularly observable in the naves which exhibit an unseemly conical block, so shaped to admit of the hoops being from time to time driven home, as the wood shrinks, in the nave of the iron wheel no such deformity is presented.

The material, being iron throughout, is not affected by the atmosphere, which in India is found so destructive to wood, causing the necessity of frequent setting up and constantly recurring outlay for repairs: even new wheels kept 12 months in store, require to be set up before being brought into use, or sent on service. The tire of the iron wheel is so firmly united to the nave, by the suspending rods or spokes, that no working can loosen it—a defect wooden wheels are at all times, and in all places, subject to. The tire or rim of the patent wheel is the only part liable to wear out; when this takes place to a certain extent, fresh tires may be applied, as in common wheels; such tires being put on at a red heat, over the cold rim, grasp it by the contraction that takes place in the process of cooling; almost as firmly as if the parts were welded together. By this simple and expeditious operation, a wheel after 20 or 30 years' service may be put in condition to perform as many more, with this difference however that the spokes are no longer capable of being removed at pleasure, the heads being covered by the new tire; but this can be of little consequence, as such repaired wheels might be appropriated to waggons or other carriages not usually exposed in action, or it might be found advantageous to withdraw the old spokes before applying the new tire, and then to drill fresh holes for a new set of spokes, or for the old ones, with heads readjusted to fit the holes, and thus a complete new wheel would be produced. These wheels are not liable to injury from any concussion, however violent, because they yield to a certain extent to the shock, space sufficient being left, within the cells of the nave to admit of a recoil or spring of the tire by the slight and simultaneous insertion or penetration of the nutted ends of the spokes to the interior surface of those cells.

The strength of the patent wheel is in proportion to the power of the rods forming the spokes to suspend a weight; these spokes not only operate in bearing the weight with which the wheels are loaded, but in binding and keeping the whole together, each acting with its opponent in suspending the nave from the rim. In common wheels, the spokes contribute little or nothing in binding the parts together, which depends solely on the tire; so that the fracture or relaxation of this, whilst the wheel is in motion, would necessarily cause the separation of all the parts. This disruption and consequent breaking down could not possibly take place in the patent wheel, even though the rim were completely severed by a cannon shot. Such was actually the case in the experiments lately tried at Woolwich, and yet the wounded wheel, which had been placed before the butt, was put on to the axle of the gun, and employed to carry it out of the field, whilst the wooden one which had been struck by the shot exactly in the same manner, was left in scattered fragments on the ground. The little model brought out by me sustained with ease 14 cwt., and might safely be loaded with a ton, and from hence a calculation may be made of the great strength of the full-sized wheels.

After an engagement, or during an action, the patent wheel may be repaired in a few minutes, in case of some of the spokes being shot away, by the introduction of fresh ones; whilst in such case the common wheel would be rendered

unserviceable: in the former, if even half of the spokes remained, the wheel would continue serviceable—not so the other. It would be superfluous to dwell on the vast advantages which might arise from the being able to keep a gun in action that in ordinary circumstances would be disabled. The iron wheel, if struck by a cannon shot, will not splinter. The trial that took place at Woolwich fully establishes this important fact. Iron wheels may be considered proof against musquetry, if not against grape. Iron wheels will need no repair over rough ground, or stony roads, or from concussions; hence forge establishments with field or battering rams may be greatly diminished, if not dispensed with altogether on this account. In support of the general efficiency of iron wheels, in constant employment for years in drags and heavy carriages of all descriptions, on the paved streets of London, reference can be had to the certificates of many of the principal brewers, builders, and practical engineers of the metropolis. The draught of the patent wheels has been ascertained to be one-fourth lighter than that of the common wheels—three horses performing the work of four.

The first cost of the patent wheels, deliverable in London, is as follows, each being 4 feet eight inches high.

|                 |                |               |
|-----------------|----------------|---------------|
| 1st, with tire, | 3 inches wide, | £18 per pair. |
| 2nd, do.        | 4½ do.         | 20 do.        |
| 3rd,            | 6 do.          | 25 do.        |

To this must be added the amount of freight from Europe, about £4 per ton. I am not exactly aware of the cost of wheels made at the Gun Carriage Agency, but according to General Hardwicke's statement, it appears fully to equal, if not to exceed, the above; but the great economy that would attend the introduction of iron wheels into the service would result from the abolition of expensive establishments kept up to supply or repair wheels not fairly worn out by service, but decayed or shrunk from exposure to the vicissitudes of alternate heat and moisture. I am not prepared to point out the various particulars in which retrenchment might be made; but it is evident, that repairs would require but little; that less than a third of the sum at present allowed for tar and grease would be more than sufficient for oil for the patent wheels; that less than half the quantity of paint would be required, and that every part of a condemned iron wheel would be worth half of its original cost, whilst the condemned parts of wooden wheels, except the iron work, are only fit for fire-wood. On this point of economy, I may quote the substance of a letter addressed by Messrs. Whitbread and Co. to the Secretary of the Honourable East India Company.

"At the request of Messrs. Theodore Jones and Co. the proprietors of the iron wheels, we beg to state to you, that the saving we have effected, in consequence of the use of iron wheels, amounts to more than £180 per annum on 35 pair of wheels. We take this opportunity of expressing our approbation of the invention in every respect. **WHITBREAD AND Co.**"

With reference to this letter, which was delivered by General Hardwicke to the Secretary, it need hardly be observed, that if a single house of business obtained so large a saving on 35 pair of wheels, the subject must be of immense importance to the Hon'ble Company, as their saving would not only be great in proportion to the number of wheels in the service, but also on account of the unfavourable influence of climate on wooden wheels.

The above remarks are fully corroborated by the following Report of experiments made with the new wheels, under the superintendence of Major-General Hardwicke

and Lieutenant-Colonel Forrest, extracted from a lithographed circular, published by the Honorable Court, dated October 19, 1831.

| as before tried. |                           |                                     |          |               |  |
|------------------|---------------------------|-------------------------------------|----------|---------------|--|
| Size.            | Height and Width of Tire. | Nature of Gun and Carriage.         | Charges. | Rounds fired. | Remarks.   |
| 24 or 18 pdr.    | Height, 5 feet, -----     | 24 pdr. Iron, -----                 | 8 lbs.   | 3             | The distance of the Guns from the Butt was about 35 yards. |
|                  | Width of Tire, 6 in. {    | Weight, ----- cwt. gr. lbs. 50 1 25 |          |               |  |
|                  | Height, 5 feet, -----     | 12 pdr. Brass, -----                |          |               |  |
| 12 or 6 pdr.     | Width of Tire, 3 in. {    | Weight, ----- cwt. gr. lbs. 18 0 5  | 8 "      | 3             |  |
|                  |                           | Ditto of Carriage, 0 0 0            |          |               |  |
|                  |                           |                                     |          |               |  |

The experiments commenced with an iron 24-pounder gun and a brass 12-pounder, mounted on travelling field carriages, and their limbers: to the 24-pounder carriage was fitted a pair of the patent wrought iron wheels; to the limber, their own wood wheels were used.

The 12-pounder was equipped in the same manner, and provided with a draft of four horses. The 24-pounder with 6. Thus prepared, both were trotted at a brisk pace, and sometimes galloped along a very rough pavement for about an hour; the wheels could not have been submitted to trial of strength more severe, some of the hollows in this pavement caused the carriages to bound from stone to stone to the extent of some feet, and the violence was so great as to break the rope lashings used to keep the guns in their places on their carriages, and the 12-pounder carriage was jerked completely off its limber.

On examination of the iron wheels after this trial, without removing them from the axle, no mark of injury was perceptible, nor a joint started: the wheels of the limbers which were wood did not resist the shaking so well, although they had only the weight of the empty limber boxes to carry; several spokes were started more or less from their sockets, one of the openings measured  $3\frac{1}{16}$ ths of an inch in width.—It may be observed, these were wheels never before used, and as they had lain several years in store, it is less to be wondered at that the wood had shrunk from the original joinings.

The next experiment was to drag the 24-pounder through marshy ground, with a weight altogether of from 4 to 5 tons, of which the limber wheels had comparatively nothing to carry, say about a 20th part of the weight.—It was started with a draft of six horses, but the weight sunk too deep for that number to drag it out, and the horses were sinking up to their knees; two more were then added, but while stopping the wheels of the carriage had sunk to a depth of 14 inches, and it required the exertions of half a dozen men in addition to set it in motion.

This experiment ought to have been begun with 10 horses, at least eight is the proper number allowed by the Regulations of H. M. service, for a 12-pounder weighing about 18 cwt.—It was therefore not to be expected, that the same number should drag through such a marsh, a load of 50-cwt. exclusive of the weight of the carriage.

This trial was not quite as conclusive as could have been desired, yet it was evident, that had the proper number of horses been given in the outset, the iron wheels would have cut their way through the swamp without a halt, but whether with the same ease as a wooden wheel, remains to be tried.—The 6-inch rim iron wheel has a tendency to sink into and plough up the soft ground, which adheres to the inner part of the rim, and accumulates, an additional weight being thus added to the wheel.—It is however to be remarked, that this objection applies only in very soft ground.

Two 12-pounders were next dragged through the same marsh. One mounted on a patent wheel on wood, and the draft applied was four horses each (half a rope); both moved through without stopping, but the draft was evidently difficult to both.—It was observed, that the iron wheels with 3-inch tire, did not collect earth about the rim as a 6-inch tire does when moving through soft ground.

The 24 and 12-pounder were next placed in battery in front of the earthen butt, and from each gun were fired three rounds with full service charges (shotted one to each)—no visible effect was produced by this discharge.

To learn what would be the effect of a cannon ball fired at one of the patent iron wheels, one wheel was placed in front of the butt: the first discharge from the 12-pounder in the battery disabled two spokes. They were struck in an oblique direction, and the ball cut them as smooth as if it had been done with a sharp cutting instrument, bending both to one side, but without a fracture or fragment flying off.

The second shot was directed to the face of the rim, which broke it, and bent one end inwards; one spoke was also cut through the nave, was grazed on the under side, one end of the nave box cracked, and a small piece cut off the opposite side of the rim.

The effect produced on the wood wheels differed very materially, the first shot from the same gun shattered two spokes, the splinters from which spread much.

A second shot was then fired at the wood wheel, placed with the face of the tire inclined to the front: the shot struck the tire a little below the centre of the nave, shivered it to pieces, and scattered the numerous fragments of the shattered wheel in all directions, some to a considerable distance.—This wheel was no longer repairable.

From the foregoing experiments, it is but justice to the patentees of the iron wheels to record the advantage under which they appear.

First They are stronger and not so easily disabled in action, and when struck with a cannon ball, do not splinter.

Secondly. When they sustain an injury to the extent of two or three spokes broken, the wheel might be continued in use till an opportunity occurred of repairing it; while a wooden wheel under similar circumstances would for the time be unserviceable.

Thirdly. The iron wheels are not subject to those changes which influence of climate and changes of seasons work on wood wheels—we have seen in the course of these experiments, that new wheels, that have lain a few years in store, would require to be set up before sent on service; no length of time can render that necessary with the wrought-iron wheels.

Under all these circumstances, we are of opinion, that the trial, which has been made at Woolwich of the iron wheels, has been sufficiently satisfactory to warrant a hope, that the further and more extensive experiments, which the Bengal Government will be enabled to make, under all the vicissitudes of Indian climate, will bring their advantages fully to the notice of the Honourable Court.

My experiments were obligingly and ably assisted by the exertions of Wesley, of the Royal Artillery, who superintended laying the guns, and done with an accuracy and effect hardly to be exceeded, and on the iron was all that could be wished for.

(Signed) THOMAS HARDWICKE, Major-General.

(Signed) W. FORREST, Lieut.-Colonel.











